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ABSTRACT

This instructor's manual for group or individual instruction in archery includes line drawings as illustrations. The manual advances from facilities to beginning instruction and general instructional practices (safety tips, instructional aids, archery etiquette) to intermediate instruction (discussions of causes of faulty arrow flight, analysis of muscles used in shooting, conditioning exercises). Included at the end are a glossary of archer's terms and a selected bibliography. (JA)

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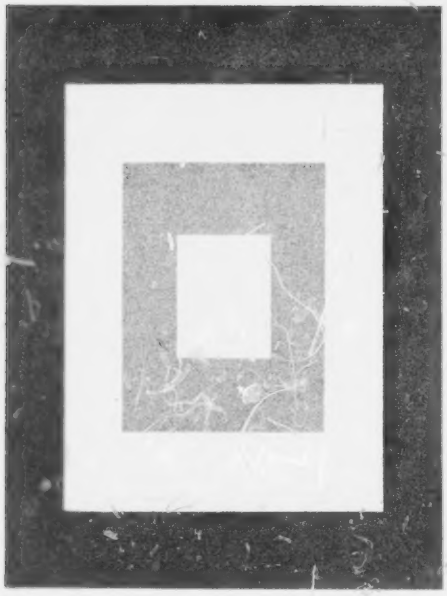

A PLANNING GUIDE FOR GROUP AND INDIVIDUAL INSTRUCTION

Prepared by the AAHPER Committee under the Supervision of
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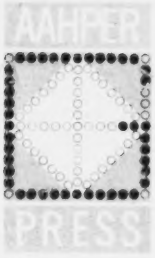

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foreword

This manual is one of a series of AAHPER publications prepared by the Outdoor Education Project. It is based largely upon the successful teaching methods in group instruction gained through many archery workshops and clinics. The manual is designed to provide practical suggestions for initiating group and individual archery instruction in physical education and recreation classes in schools and colleges, and in programs conducted by camps, recreation departments, and other agencies concerned with teaching skills and sports that have lifetime interests for increasing numbers of people.

Like other AAHPER instructional materials, the first draft of this manual was prepared by a committee of experienced teachers and leaders in archery and was subsequently field tested in hundreds of workshops and clinics and submitted to other experienced archery instructors for suggestions.

AAHPER gratefully acknowledges the cooperation of the American Archery Council in supporting the archery segment of the Outdoor Education Project which has been responsible for initiating and developing archery instruction in many schools, colleges, and recreation agencies. Special recognition is given to the following committee members who assembled the materials and methods presented in this manual:

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introduction

The increasing importance of the constructive use of time is a challenge to schools and recreation agencies to provide opportunities for people to acquire interests and skills that have lifelong values. Archery, long recognized as a valuable and satisfying sport, is growing in popularity as an individual and family activity.

In order to provide opportunities for people of all ages to learn the basic skills underlying all forms of archery, group instruction is necessary. In schools, colleges, and public agencies particularly, archery instruction should be available to all students and participants.

In every group, archers will exhibit a wide range of physical characteristics, muscular coordination, and experience. Some procedures for archery instruction presented in this manual are based on the principle that all who desire to learn the skills should have equal opportunities to develop their own interests and abilities, and that sufficient space, facilities, and equipment should be provided.

Two important ingredients in effective group instruction for beginners are *immediate participation* and *immediate success*. This is in keeping with the fundamental principles of learning. Review, correction of faults, and adaptation to individual differences with practice and coaching normally follow as in teaching all skills.

This manual presents a method of group instruction especially designed for beginning students, with provisions for progression in competence for engaging in many types of archery activities suited to the students' interests. There is much more detailed information about many aspects of the sport which can be found in many excellent reference materials (see Bibliography, p. 63).

Those who teach archery should possess reasonable skill and the ability to employ effective instructional techniques. In too many instances, unqualified individuals have been "drafted" to teach archery. In these situations in-service education is vital. An increasing number of in-service workshops, clinics, and special classes are offered by the Outdoor Education Project of AAHPER, colleges and universities, professional associations, and other groups.

It is hoped that this manual will be helpful to all who have the opportunity to teach archery in schools and colleges, recreation and camp agencies, and adult groups.

facilities

INDOOR FACILITIES

Shooting Area

Areas that can be used for shooting include a gymnasium floor or balcony, a band room, a stage, a furnace room, a multipurpose room, or wide corridors. Although an area that measures 90 by 90 feet is ideal for the average beginning class, this is not always possible. An area of 30 by 50 feet is satisfactory; it can accommodate as many as 10 36-inch target matts and 40 shooters. If space is limited, however, classes can be conducted effectively in a smaller area.

Targets

Target matts.

The types of target matts available are round matts of johnson grass or straw, and square matts of excelsior or plastic foam. *Excelsior or straw matts that are used indoors must be fireproofed.* This manual suggests 36-inch matts because they are a practical size for instruction and are lighter in weight and easier to handle than a larger target. The newer plastic foam matts are especially portable and practical where targets must be taken in and out-of-doors for each shooting session.

Target faces.

For basic instruction it is suggested that target faces be 36 inches (or same size as matts being used) and four-color (five rings—gold, red, blue, black, white). If possible, a paper target face should be glued to corrugated board (cardboard) before attaching the face to the matt; this will increase the target life many times. Faces can also be purchased with cardboard backing.

Target faces are attached to the matt with commerical target pins or pins made from clotheshanger wire or equivalent. Use a piece of wire 14 inches long for each pin. Make a right angle at 3 inches and bend the 3-inch piece so that it is curved. Put the remaining 11 inches of the wire through the target face and matt and bend it at the back. There should be four pins in each target face.

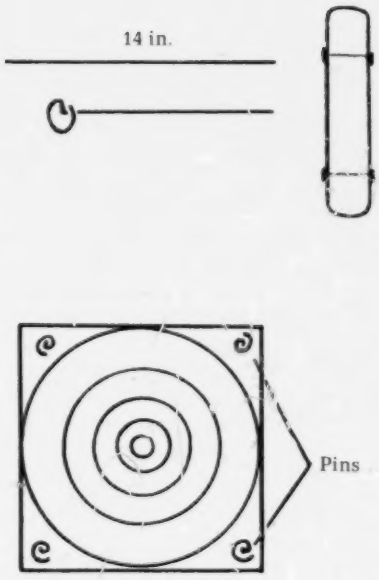
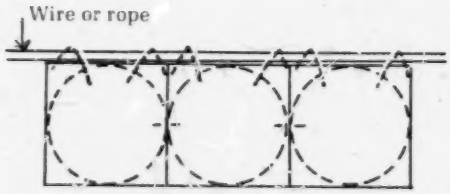


Figure 1. Target pins.

Target installation.

Target matts are placed on stands or are held in place by wires or ropes. This can be done by attaching wire loops to the top of each matt and stringing the loops onto a wire or rope that is attached very securely to standards (such as badminton or volleyball) anchored to the floor or to hooks anchored in the wall. The top of the target matts should be angled slightly backward. If a matt should fall, it will then fall backward and thus not break arrows that might be in the target.



Solid lines represent square matts; dotted lines represent round matts. Round matts should be wired to each other at the sides.

Figure 2. Set-up of target matts indoors.

Target arrangement.

The instructor's position in relation to the targets and the shooting line during an archery class is of utmost importance. The targets should be arranged so that when students are facing the targets, the instructor will be to the right of them. This will allow the instructor to stand a few feet to the right of the shooting line to observe the shooters and to be heard by all students. Each right-handed shooter will then be facing the instructor when in position at the shooting line.

Shooting Line

To designate the shooting line, floor marking tape or masking tape should be placed on the floor 20 feet (and/or other desired distances) from the base of the targets. If tape is impractical or unavailable, a rope or measuring tape may be used.

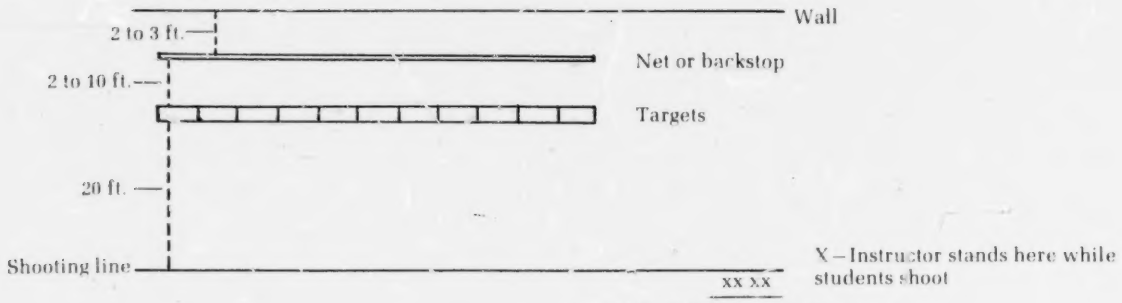


Figure 3 Range layout for indoor instruction.

Backstop

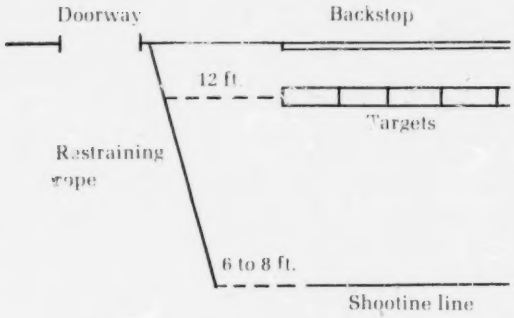


Figure 4. Indoor range showing safety restraining rope.

A backstop should be hung 2 to 3 feet from the wall and 2 to 10 feet behind the targets to prevent arrows from hitting the wall. Suitable backstops include commercial nylon backstop nets which are very effective in stopping arrows; an old rug or series of rugs or moving van carpets; parachutes; canvas; or cellotex. If a cellotex board is used, a minimum of 8 feet should be allowed between the targets and the backstop. If a fabric backstop is used, it should be attached at the top only to allow flexibility to absorb the shock of the arrows and prevent penetration.

Any indoor backstop should be a minimum of 8 feet from the top to the floor. If there is concern about the possibility of arrows hitting and damaging the floor in front of the targets, such as in a gymnasium, it is helpful to rest the targets on rubber runners, canvas-covered tumbling mats, or a rug extended 6 to 8 feet in front of the targets. Beginning students, however, tend to shoot high, so generally there is little need to worry about damaging the floor.

Point of Safety. Whenever possible, arrange facilities so that there is no possibility of nonparticipants inadvertently walking behind the targets while shooting is in progress. In the event a path of traffic must cross the room, secure a restraining rope diagonally from the shooting line to the targets with a distance of 6 to 8 feet beyond the end of the shooting line and a distance of 12 feet beyond the target line.

OUTDOOR FACILITIES

Shooting Area

Use any outdoor area on the school site – the football field, practice field, hockey field, playground, or tennis court. Safety must be the prime factor in all instances. Grass or dirt surfaces are preferable, but not necessary.

Target Installation

The range set-up is basically the same as indoors, with a few exceptions. Wire loops should be secured through the sides of the target matts rather than through the tops of the matts, with metal or wooden stakes or posts placed through the loops and anchored securely in the ground.

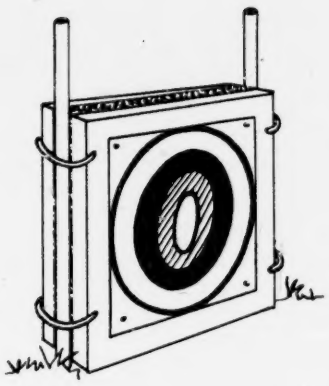


Figure 5. Set-up of target matt outdoors.

Non-permanent targets.

When targets must be installed and removed for each archery class, the movable kind is recommended. They can be set up in the following manner:

Pipes that are 2 feet long and 1½ inches in diameter should be spaced 38 inches apart and driven into the ground until the top end of each pipe is slightly below the surface of the ground.

Prior to each class, the instructor and/or students can insert a pipe or stake that is 5 feet long and 1 inch in diameter into each of the recessed pipes and secure the target matts to the pipes or stakes by attaching two wire loops on each side of the matt and sliding the loops onto the pipes or stakes (see Figure 5).

If desired, the recessed pipes can have a threaded end so that a cap can be placed over the pipe opening. This will prevent rain and debris from falling into the pipes when the range is not in use.

Commercial movable target stands can also be used. Tripods can be used, although they are more cumbersome to transport and set up. In an outdoor range, the tripods should be anchored. Another idea for target stands is to use track hurdles upside down and wire the matts to the legs.

Permanent targets.

Permanent targets can be installed in the following manner:

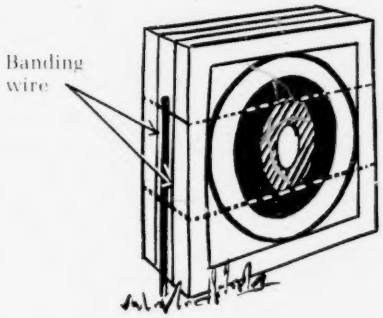


Figure 6. Bales banded together for permanent outdoor target.

Each target will require two supports. The supports should be approximately 6 feet long and can be of the following materials: 1-inch pipes, 2½-inch cedar posts, 2- by 4-inch wooden stakes, or steel fence posts. Stakes should be driven into the ground 38 inches apart and to a depth of at least 2 feet. An old rubber tire or 2 by 4s should be placed on the ground between the two supports.

The bottom bale of excelsior or straw should be placed on top of the tire or 2 by 4s so that it does not rest on the ground. This preserves the bales and eliminates arrows sliding underneath. Two more bales should be stacked on top of the first, and all three bales should be banded together by using a banding tool or two straps of No. 8 wire. This is done by completely encircling the bales and tightening the wire. If four or five bales are desired, the target supports should be within 6 inches of the top. Supports should never extend higher than the top of the bales.

When using metal supports it is best to cover the surface of the supports with heavy rubber, such as old car tires, bicycle tires, or rubber hose cut in half lengthwise. To protect excelsior or straw bales from too much water, the top bale should be capped with a protective covering of plastic or roofing paper.

In the layout for indoor shooting, target matts are placed side by side, touching each other. If space permits (especially outdoors) spacing targets 3 feet apart provides more room for shooters and ease of retrieving arrows.

Shooting Line

A shooting line can be indicated by marking compound or with a rope or measuring tape stretched between stakes. The stakes should be placed directly in front of each target. For a permanent range, cement or patio blocks, bricks, or similar blocks can be recessed into the ground to indicate shooting positions. The distance from the target face to the shooting position could be painted on the face of the block.

The modified Chicago round is shot from the 20-yard distance. In the modified Flint round, six different distances are needed: 20 feet, 10 yards, 14 yards, 15 yards, 17 yards, and 20 yards. (These

rounds are described on p. 29). When students are shooting at different distances at one time, one common shooting line should be used and the targets should be set at various distances.

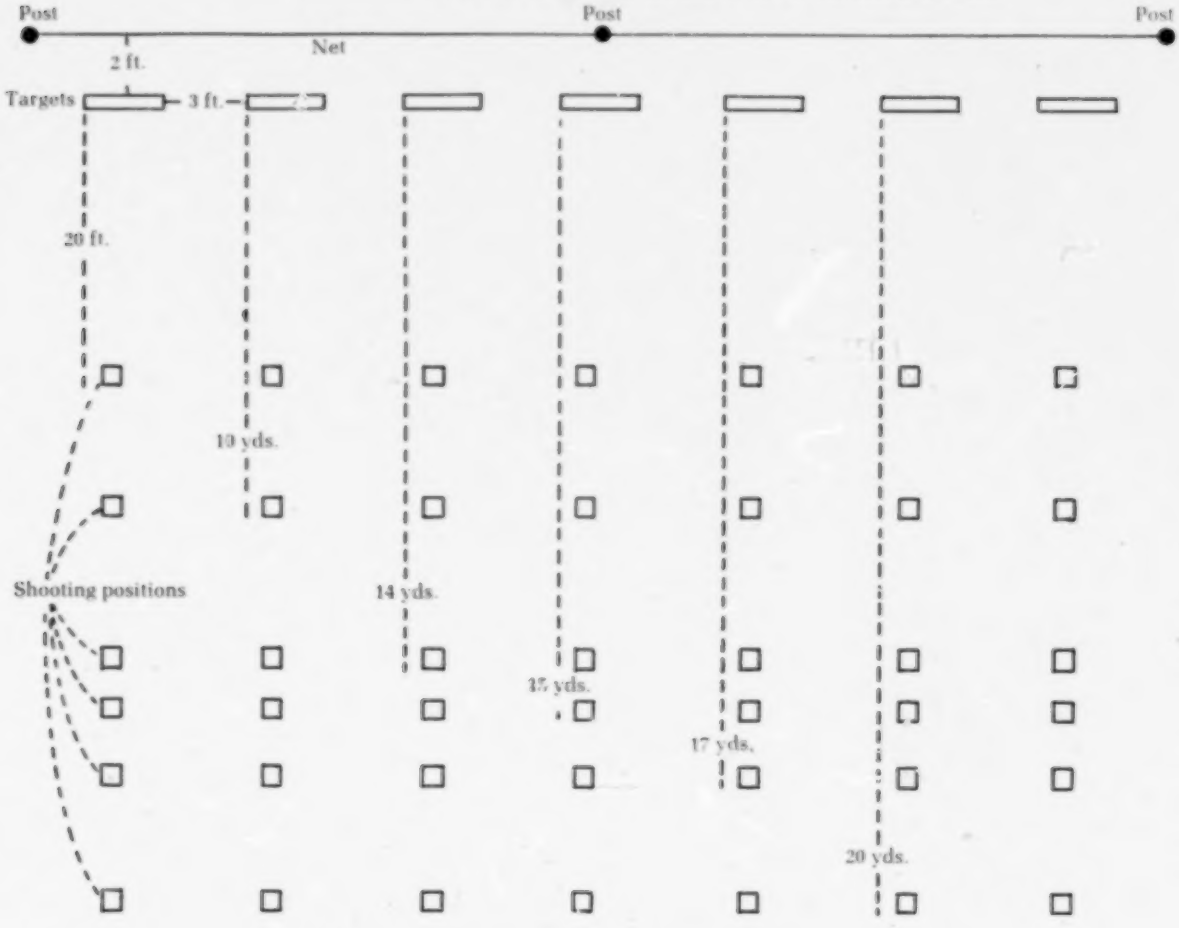


Figure 7. Suggested range layout for outdoor instruction.

Backstop

If a backstop is used, it should be of a "see-through" type (e.g., a nylon net) to enable the instructor to have complete visibility behind the target line. Posts on which the net is hung should be approximately 25 feet apart. The net should be hung from a heavy wire (No. 8 clothesline) placed 9½ feet from the ground. The recommended net height is 10 feet.

When shooting from beginning distances (20 feet to 20 yards), there should be a minimum of 30 yards clear behind the targets if no backstop is used. A hill is a natural backstop, but care should be taken to prevent anyone from wandering from behind the hill while class is in session.

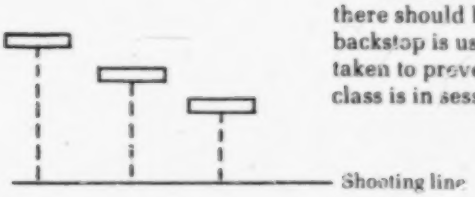


Figure 8. Staggered targets, for shooting at various distances.

BEGINNING INSTRUCTION

equipment

A major factor in good group instruction is sufficient equipment for maximum participation. Ideally, each participant should have a complete outfit of archery equipment, but through good instructional methods a lesser amount of equipment can be effective.

While it may be the practice of the school or agency to provide equipment for instructional activities, archery is somewhat different in that it has more individual equipment which may make it practical in some instances for the students to purchase some items, such as the arm guard, finger tab, and/or arrows. Some variations in providing equipment are:

1. School or agency furnishes adequate equipment for maximum class.
2. School or agency furnishes equipment for half of maximum class.
3. School or agency furnishes bows; students purchase arrows and/or arm guards and finger tabs—or these are furnished on a fee basis.

Note that personal bows should not be used in beginning classes, but may be used in intermediate instruction, and are recommended in advanced shooting. Reason: If the student has his own matched equipment, it's probable that he has shot before. It is much better to have the entire class start on an equal basis with similar equipment.

For the learning experience to be most beneficial, each student should have a 20- to 25-pound bow, an arm guard, a finger tab, a quiver, and six arrows. If it is not possible for each student to have a bow, one bow might be shared by two or more students. Finger tabs and arm guards can be purchased at a nominal cost and much time can be saved if each student has these items.

SPECIFICATIONS

Bows

The ideal bow for beginning instruction is relatively short (56 to 64 inches), lightweight (not more than 20 to 25 pounds draw weight), and recurved. The short length is more efficient and the light weight enables the student to learn the basic skills without struggling to draw back the string. *Note that the bow weight is given at 28 inches draw length unless otherwise specified. For each inch under or over 28 inches, the weight decreases or increases approximately 2 pounds.*

Modern recurve bows are either made entirely of fiberglass or are a composite of wood and fiberglass. Fiberglass and composite laminated bows are both satisfactory for beginning instruction; fiberglass bows, however, require less care, are less expensive, and are more serviceable for beginning classes. Intermediate and advanced groups should use laminated bows, which have superior shooting characteristics.

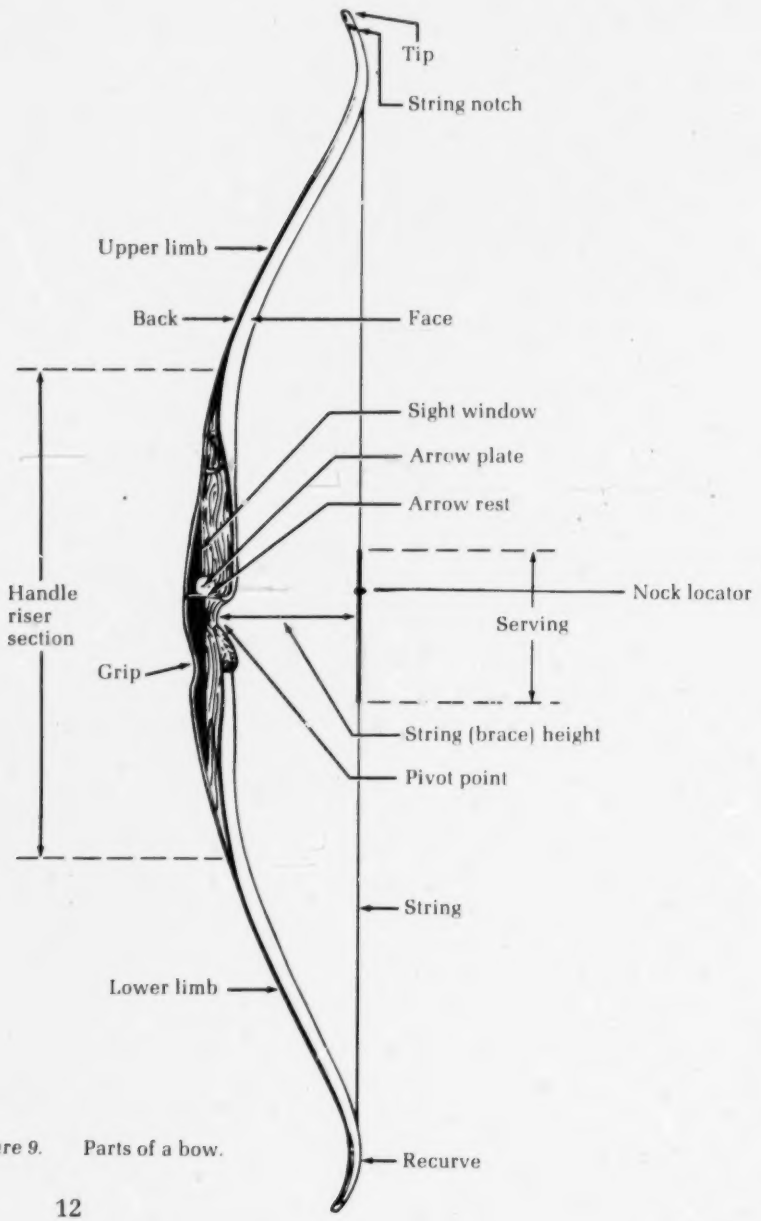


Figure 9. Parts of a bow.

When purchasing bows, be sure to consider that some shooters will be left-handed. If purchasing fiberglass bows, select a type that can be shot from either side; if purchasing laminated bows, about 10 percent should be left-handed.

If not equipped with bow sights, mount a 7-inch piece of plastic or masking tape on the back of each bow from the arrow shelf up. Adhesive tape should never be used because it "cures" with age and will damage the fiberglass. In later instructional periods each student will be furnished with a pin to put in the tape. This pin will be used to learn sight shooting.

Bowstrings

Every bowstring must have a nock locator. Generally, the arrow should be nocked approximately ⅛ inch above 90 degrees from the arrow rest to the string. This point can be found by using a folded magazine over the string to the arrow rest (or shelf) or a commercial bow square which automatically indicates the nocking point as well as measures string height. Commercial nock locators are available, or dental floss or plastic tape will usually suffice. The nock locator is positioned on the string just above the point where the arrow is nocked.

The string loop on the upper limb will be a little larger (¼ inch) than the loop that fits on the lower nock of the bow. When the bow is not strung and for storing, the larger loop fits over the upper limb of the bow; the smaller loop fits into the nock. Commercial tip protectors will hold the string in place, or a rubber band stretched around the string and bow will hold the lower loop in place.

Replacement bowstrips should be ordered according to length and weight of the bow. For example, if a bow is marked 56 inches, 20 pounds, order a 56"-20# string. Do not order by the actual measured length of the string because the manufacturer measures the string under considerable tension. If the bow is not marked, check with the manufacturer.

Arrows

For beginning instruction arrows need not be matched in spine and grain weight. While wood arrows are of lower initial cost, consideration should be given to purchasing fiberglass arrows, which have fewer repair and replacement problems and may, over a period of time, be more economical. When purchasing better grade arrows they should be matched in weight to the bows being used. For example, if 25- and 30-pound bows are used in intermediate or advanced classes, the matched arrows should be marked 25/30# or 30/35#. Wood arrows should be of cedar since the lowest price arrows are often of inferior wood and straightness.

For purposes of planning, the following *averages* may be helpful:

The average adult male will use a 28-inch arrow.
The average adult female will use a 26-inch arrow.
The average teenager will use a 26-inch arrow.
The average subteen will use a 24-inch arrow.

Two methods of measuring students for proper arrow length are:

1. Place arrow nock in the middle of the chest, extend arms, palms together. Point of arrow should extend a minimum of ½ inch beyond the fingertips when arms are stretched.
2. Use a training bow (10 pounds or less). Secure an eye hook in the end of a ¾-inch dowel, 36 inches long. Make a mark on the dowel

24 inches from the hook end and every inch to 30 inches. Slip the bowstring through the eye hook. To measure length, have student draw to the corner of his mouth; the number of inches indicated on the dowel will be the arrow length needed.

Point of Safety: It matters little if the arrow extends beyond the bow an inch or two for beginning instruction, but *the arrow should never be too short.*

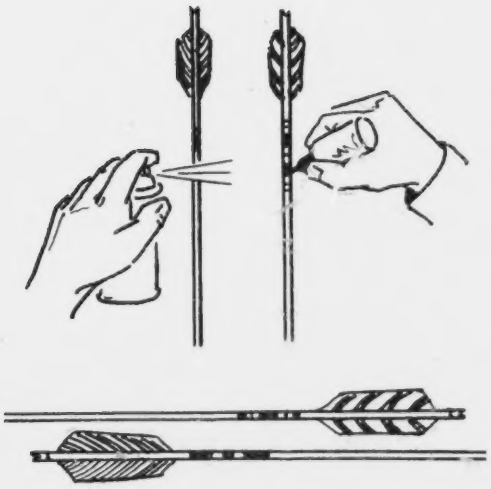


Figure 10. Cresting arrows.

A student's arrows should be all of the same length. Each student should have a set of arrows with matching crests. Shooters on one target should have arrows which are crested differently for easy identification. If arrows are not purchased in sets which are already crested, this can be done with a felt pen or spray paint, with students designing their own patterns. (Cresting arrows might be an art class project.) Different color nocks are also a good variation.

To help eliminate the problem of beginning students dropping the arrow when they first learn to draw the bow, it is advisable to either pinch the arrow nocks or build up the serving on the bowstring. In either case, the nocks should be very snug on the bowstring. To pinch the nocks, hold the nock of the arrow in a pan of boiling water for about 10 seconds; then, with the thumb and forefinger, pinch the ends of the nock together until the opening is almost closed. This will allow the student to snap the nock on the string and have the security of knowing that the arrow will not fall off the rest, yet it does not inhibit the flight of the arrow. If pinching the nocks is not desirable, the serving of the string at the point where the arrow nock will be placed can be built up with one or two layers of dental floss.

Quivers

A side quiver of a minimum 16-inch length and preferably a type with a belt clip (because it can be hooked onto a skirt or trousers waistband and does not require a belt) is recommended for group instruction. To prevent losing the clip, tape can be wrapped around the loop attached to the quiver ring. Ground quivers at the shooting line are sometimes used.

Arm Guards

Arm guards should have at least two straps. Training arm guards, which cover the area from the bicep to the wrist, are also available.

Finger Protectors

Finger tabs are preferable to gloves for group instruction because they present fewer fitting problems. A glove will take a set. Intermediate and advanced shooters may prefer to use gloves but this is more personalized equipment.

There are two types of tabs: the western style with two finger holes and the Marshall style with a single finger hole. The Marshall style is easier to use in beginning instruction because it is simpler to fit and can be swung around on the back of the hand when not shooting. Approximately 10 percent of the finger tabs should be for left-handed shooters.

Point of Safety: Every shooter must use an arm guard and finger protector.

COST OF EQUIPMENT

The prices listed below are for good quality, medium-priced equipment suitable for beginning classes.

ITEM	SPECIFICATIONS	APPROXIMATE PRICE RANGE
Bows	20# to 25#; 56" to 64"; recurve type	
	Fiberglass	$10.00-15.00
	Laminated	25.00-50.00
Arrows	24", 26", 28" (also some 30" if teaching men)	
	Need not be matched in spine and grain weight for beginning instruction	
	Cedar	.50- .75
	Fiberglass	1.50- 2.50
Quivers	Side quiver with belt clip, 16" or longer	1.50-up
Arm guards	Two-strap	1.00- 3.00
	Training arm guard	3.00- 6.00
Finger protectors	Marshall style tab (single finger hole)	1.00- 1.75
Target matts	36" size	20.00-35.00
Target faces	36" size, 4-color	1.00- 3.50

STORAGE, CARE, AND SIMPLE REPAIR OF EQUIPMENT

Bows

Number all bows and other equipment that are used by more than one person for quick and easy identification. For bows, it is best to use a stick-on type label on the face of the lower limb, writing the number on the label with indelible ink and then covering the label with transparent tape. CAUTION: *Do not use adhesive tape on bows. Also, do not use felt marking pens on composite bows because the glass will absorb the ink.* If a permanent marking is desired, the number can be burned into the handle section on the outside (away from the sight window) with a wood burning tool. Numbers should be large enough to be recognizable at a glance. On leather items, such as quivers and arm guards, it is best to use indelible ink.

Storage and care.

Laminated bows may be stored in several ways. One of the best ways is to cut a piece of ⅛-inch Masonite with "V" notches every 2 inches and hang on a wall. These notches should be 1¼ inches wide at the base of the triangle. Another method of hanging laminated bows is to nail corks into a wall so that two corks almost touch (about 1/32 inch between them). The upper limb of the bow is then pushed between the two corks and friction will hold the bow. There should be approximately 2 inches between each set of corks. A third method is a series of pegs extending out from the wall 6 to 14 inches, and 18 inches apart. Bows can be laid upon these pegs by the riser section of the bow. Laminated bows should never be suspended on pegs by the *limbs*. If metal pegs are used they should be covered with surgical tubing to avoid marring or scratching the bow. A simple way to hang bows is by the bowstring on a nail in the wall. This is not recommended, however, as it wears the bowstring and, if the string slips off the bow, the bow falls.

Bows should be stored in an area that is not excessively dry or moist, and where the temperature never exceeds 80 or 90 degrees. At

least once a year, a coat of furniture wax should be applied to each laminated bow, and the string grooves and nocks should be cleaned of accumulated dirt. At this time, the bows should be checked; arrow rests and plates that are excessively worn should be replaced. Replacement parts for bows can be obtained from an archery supplier. If strings on a particular bow are fraying frequently, check the nock of the bow. If there is a sharp edge, carefully round it off with a light nail file.

A bowstringer should be used in stringing all bows, and most particularly, laminated bows. There is little lateral stability in a laminated bow, and continued twisting of a limb will cause the bow to break. If, for any reason, a bow should show a check mark, crack, or the bow breaks, write to the manufacturer, describing as accurately as possible the place and extent of the break, and inquire about steps to be taken. Most manufacturers do not allow dealers to replace bows and, in most cases, a manufacturer will advise the return of the bow for inspection.

When to replace a bowstring.

Bowstrings will last a very long time with a minimum amount of care. It is advisable to wax bowstrings two or three times a season with a special bowstring wax available from archery suppliers. When a strand breaks or the end loops of a string become frayed, the string should be replaced immediately. It is unwise to try to make a bowstring last a little longer, for if a string should break while the bow is at full draw, there is a chance that the bow will also break. There is an over-serving on the end loops and the center of the bowstring. If this serving comes loose on the end loops, it can be repaired by simply winding it back in place and tying it off with the same system that is used in tying off fishing rod ferrule winds. The center serving may come loose or may wear excessively, while the rest of the string is perfectly good. This may be replaced by using serving thread, which can be purchased through an archery supplier; instructions come with the thread.

Storage and care.

Arrows

Arrows with wood shafts can become crooked very easily. If arrows are in constant use, it is probably best to store them in quivers between classes. For inexpensive, lightweight storage of arrows, use a cardboard box with the top glued shut. Turning it upside down, punch holes of a size to hold a set of six arrows (in or out of quivers). With a felt pen, mark the arrow length on the cardboard. A rope attached to each end makes carrying easy. If arrows are to be stored for a length of time a regular arrow rack of Masonite or plywood should be purchased or constructed (Figure 11).

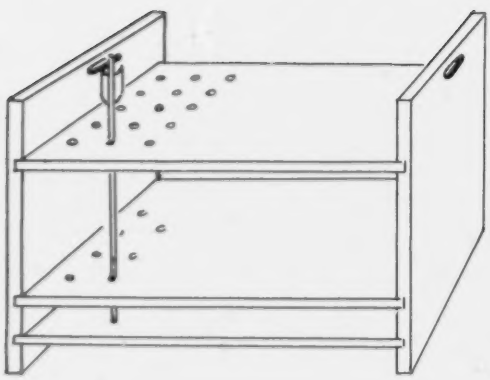


Figure 11. Arrow storage rack.

If the feathers of an arrow become matted, hold them over the steam from a teakettle and swirl the shaft in your hand. CAUTION: *Do not hold the arrow over the steam for more than a few seconds at a time, as excessive moisture will loosen the glue.* By twirling the arrow, the feathers will return to their original shape.

If an arrow is excessively crooked, find the point on the shaft where it is out of line to the greatest degree and hold that point over dry heat, such as an electric stove, until it becomes very warm. CAUTION: *Be careful not to burn the shaft.* Then, using the base of the palm of the left hand on that point, bend the arrow in the opposite direction by using the other hand on the nock end of the arrow. Normally, the bend will be in the center of the shaft, but if it is close to the feathers or very close to the point, the arrow cannot be straight-

ened. Keep sighting down the shaft and applying heat and bending until the arrow is straight. Aluminum arrows can be straightened in the same manner, but without heat. With practice it is relatively easy to straighten any arrow, except those with fiberglass shafts.

Replacing a nock.

Replacement nocks can be purchased from an archery supplier. The nocks should match the shafts in size—for example, 5/16-inch nocks should be used on 5/16-inch shafts. However, a 5/16-inch nock also can be fitted to an 11/32-inch shaft, but an 11/32-inch nock will not fit a 5/16-inch shaft.

If part of the old nock remains on the shaft, cut it away with a knife, being careful not to cut the shaft. If it is especially difficult to remove, it can be burned; however, the nock end of the arrow should be up so that the flame will not touch the feathers. Before the plastic is completely burned, the flame should be blown out; the heat should allow the nock to come off completely. Scrape the tapered end of the shaft to remove old glue. Place a drop or two of fast-drying cement in the nock (not on the shaft), and push the nock onto the shaft in a continuous, twisting, clockwise motion. This will spread the glue completely around the taper and inside the nock, and will eliminate any air pockets in the nock. After the nock is on as far as it will go, line up the index (the raised portion of the nock perpendicular to the groove) with cock feather. Remove any excess glue and allow to dry.

Replacing a point.

There are two types of points—the insert and the slipover. Insert points are used only on tubular shafts such as glass or aluminum. Slipover points are used primarily on wood arrows, but may also be used on glass or aluminum.

Often wood arrows are broken on the point end. This does not mean that the arrow is useless; simply cut the shaft to the next shorter length and put on a new point. As with nocks, the point must be the proper size. Point sizes are the same as shafts, so for 5/16-inch shafts purchase 5/16-inch points, etc. It is helpful to have a taper tool which can be used to taper the shaft for both nock and point and to tenon a shaft for a slipover target point. The adhesive recommended for attaching points is ferrule cement in either liquid or stick form.

Using liquid cement, coat the point end of the shaft with the cement, light it with a match, and, as the flame starts to die down, push the point onto the shaft. Using the stick form, break a little chunk of the cement off the stick and put it into the point. Hold the point with a pair of pliers over an open flame until the cement melts. When it is melted, push the shaft and point together and allow to cool. In either case, after the point has cooled, use a nail and hammer to indent the four sides of the point. Hold the nail on the ferrule of the point and strike a sharp blow with the hammer. A crimping tool can also be used to keep the point in place. Insert points are handled in the same manner, except that liquid cement is preferable because it must be put on the insert part of the point rather than on the shaft. Most manufacturers include instructions with their arrows on how to replace points.

Replacing a feather.

A fletching tool is recommended; it should include instructions for replacing a feather. However, individual feathers can be replaced on wood arrows by purchasing die-cut feathers from an archery supplier.

The die-cut feather should have the same trim and shape as the other feathers on the arrow. Prepare the shaft by scraping with a knife the place where the new feather is to be applied so there is no rough spot. Pick up the die-cut feather, being careful not to put your fingers on the quill, as they will leave oil on the quill and the glue will not adhere correctly. Place a straight pin on the trail (back) end of the feather and put this closest to the nock, pushing the pin into the wood shaft. Apply glue to the quill. Then lay the whole quill in place in the same direction as the other feathers on the arrow and put another straight pin on the lead edge of the feather. After the feather is secured in the proper direction, put two more straight pins through the quill on either side of the feather to hold the quill in place while the glue is drying. Additional glue may be needed along the edges of the quill. There should be no bend in the quill to allow an air space between the quill and the shaft. After the glue is dry, remove the pins and apply an additional drop of glue to the very lead edge of the feather. Allow it to dry slightly, then press on it with the thumb so there will be no sharp edge on the feather. A fast-drying glue, such as airplane cement, should be used in replacing feathers.

In nearly every community there is an archery club or at least an archery enthusiast. It is a good idea to check with the archery supplier to try to arrange for repair of arrows. If this is not possible, it is suggested that the local archery club be contacted to find an individual who would be interested in refletching and rejuvenating arrows. This is advantageous—both in economy and in the additional help a knowledgeable person can give in other phases of the sport.

When to discard an arrow.

Any arrow developing splinters or a crack should be broken immediately and thrown away. One of the hazards in archery is that of an arrow "exploding." This only happens when an arrow is used that should have been discarded. It is advisable to have students check their arrows for cracks and gouges prior to shooting in each class period. If there is ever any doubt, do not shoot the arrow.
CAUTION: *Never try to repair a cracked arrow.* The best way to determine if an arrow is cracked is to hold the arrow nock between thumb and forefinger with the point toward the ground. With the other hand, snap the middle of the shaft with the finger and listen for a vibration. If the arrow is sound, there will be a dull thud; if the arrow is cracked, there will be a slight "tinny" vibration sound. Points can be salvaged from cracked and broken arrows, but it is impractical to try to salvage the nock or feathers. An arrow that is splintered only at the point might be cut down to the next shorter length and a new point put on the shaft.

Off-Season Storage of Bows and Arrows

Arrows should be stored in regular arrow racks so that they are held straight. Both bows and arrows should be stored in an area where there will not be excessive humidity and the temperatures will not exceed 85 or 90 degrees. Heat is the worst enemy of laminated bows, with humidity running a close second. Heat and humidity can ruin arrows. When storing bows do not stack too many in one pile, as the weight could damage the bottom bows. Arrows should be covered. A few mothballs stored with them will prevent crickets and other insects from eating the feathers. Leather accessories should be kept in a dry place safe from rodents. Laminated bows should never be suspended by the limbs nor should there be any weight on the limbs.

instruction

The basic philosophy underlying this method of instruction is to give the student an activity with lifelong participation values and to teach him to have fun shooting a bow and arrow. To achieve this goal, the instruction is based on immediate participation and immediate success. For example, targets are placed on the ground rather than at the traditional 48-inch level because fewer arrows miss the target when it is on the ground. Thus, more class time can be spent on shooting and less time on looking for arrows. Beginning students tend to shoot high because they want to look at the point of their arrow; having targets on the ground, and starting at a short distance (20 feet) tend to cause students to lower their bow arm, thereby hitting the target with their first group of arrows. This combination of targets on the ground and a short distance, plus the use of a lightweight bow and the instruction procedure presented in this manual help students achieve immediate participation (shooting in the first class period) and immediate success (hitting the target with the first group of arrows).

This manual and the method presented are based on the premise that these are beginning classes and the goal is to provide opportunities for all to learn basic archery skills. It is not expected that the individual will stop with this basic instruction. As in other sports comparable to archery, at least some of the participants will wish to improve their skills and enter the competitive field, engage in bowhunting, and participate in other archery activities.

Effective group instruction implies that each member of the class must participate in the learning activity as though he were the only member being taught. The best that is known about learning can be applied effectively to the teaching of archery and/or its component skills and techniques.

Learning is change of behavior, and is based on two factors: how the learner perceives himself, and how he perceives the situation he is in. Among the crucial perceptions of an individual who is learning archery are those related to the teacher's demonstrations and verbal instructions, the attitudes and skill levels of other learners in the group, kinesthetic perceptions from his own body and the relationship of the bow and arrow to it, the student's proximity to the target, audiovisual aids utilized, and past experiences in learning skills, successful or not.

The teacher provides a learning environment rich in resources and facilitates learning for the individual by helping him perceive more accurately the various movements or movement patterns involved in archery.

Very important is the teacher's attitude toward the learner. If the individual perceives that the teacher has little or no confidence in his ability to learn archery, it is doubtful that he will make much progress. No matter how excellent the instructional techniques, if the student is not helped to see that archery has meaning for him, the instruction will not be completely effective.

The suggested instructional procedure in the following section is a positive approach with a sequential arrangement of teaching content and methods. There is unlimited opportunity for the creative

teacher to utilize new and effective methods and instructional resources.

CLASS ORGANIZATION

Figure 12. Method of determining eye dominance.

Prior to issuing equipment, check each student for eye dominance. This can be done in several ways. One of the simplest ways to determine this in a group is to have the students face an object, such as the target, their arms extended with open palms toward the target. Their two hands and thumbs should overlap so that there is a small opening between the two hands. With both eyes open have the students center the bullseye in the opening made by their hands. Then have them close their left eye. If the object remains in the opening those students should shoot right-handed; have them drop their hands. The remaining students should again center the object in the opening with both eyes open and close their left eye. Those who do not see the object in the opening with the left eye closed should shoot left-handed.

Visual dominance is unrelated to visual acuity. The reason for this test is that the dominant eye will automatically align any lineal object projected in front of it. Therefore, if the left eye is dominant and the student shoots right-handed, he will tend to shoot consistently to the left. Occasionally there will be a student with "non-dominance", he can shoot from either side, whichever seems natural.

Call the students' attention to suitable attire for shooting and suggest that, if possible, they wear a knit shirt or fairly close fitting shirt or blouse, preferably with short sleeves. Caution the class to remove objects such as pins, pencils, loose sweaters, and watches from the shooting side (left side for right-handed shooters). This is an important safety factor and you should check this on the shooting line at every session.

Before issuing equipment at the first session, caution the class merely to hold the items issued and not try to put on the leather or shoot an arrow until instructed to do so.

Bows should be already strung when issued to a class at the first session or sessions. (Stringing and unstringing the bow will be taught later.) It is desirable that bows be strung with a commercial bow-stringer which can be purchased at moderate cost.

Student assistants can check equipment out and in. After students are checked for arrow length, equipment can be issued from an equipment room or from mobile equipment racks brought to the shooting area. For example, a blackboard on a movable stand could be adapted for a bow rack; movable arrow racks can be used; and leather accessories can be laid out on a table.

All tackle should be numbered. Corresponding numbers on storage racks facilitates checking out tackle and returning it. A student should use the same tackle in each class period. It is helpful to make up a chart with each student's name showing the identification number of the tackle issued to each student and target assignment. It is psychologically desirable if target assignments are rotated from time to time. Students should be responsible for returning equipment to the proper place at the end of the session. If it is within the school policy, students should be allowed to check out tackle for weekend use, particularly at the college level.

Consistent class procedure saves time and avoids confusion. Consistency in checking tackle in and out, for example, will result in a minimum amount of time in handling equipment, allowing more time for instruction and shooting.

For beginning instruction it is suggested that left-handed shooters be grouped at the right end of the shooting line to allow them a better view of the instructor as he demonstrates (see Figure 3, p. 8).

Instruction takes place at the shooting line. Regardless of the size of the class it is recommended that a partner system and Lines A and B be used. If equipment or space is very limited, a third line, Line C, can be used. If equipment is shared, particularly arrows, be sure students are matched with partners who require the same length arrows.

Explain the use of the whistle before beginning instruction:
One whistle means begin shooting or retrieve arrows. The whistle to retrieve arrows will be blown when all shooters have completed shooting and have stepped back from the shooting line.
Two or more whistles mean danger or emergency situation—all shooters stop where they are, return arrows to quivers, and step back from the shooting line.

INSTRUCTIONAL AIDS

In this method of instruction there will be 10 steps in the shooting of each arrow. Probably the most important instructional aid is to have these steps printed on cardboard or other poster material (approximately 22 by 30 inches, with letters at least 2 inches high, to be readable at a distance of 20 yards). The words are "trigger phrases" to initiate an action. You will note that the shooting of an arrow is divided into two parts—static and dynamic. In the static part there are no muscles under great tension, in the dynamic part the proper muscles are under tension.

Steps in Shooting an Arrow

STATIC	*DYNAMIC*
1. Stance	7. Draw-anchor
2. Nock arrow	8. Aim—hold
3. Set hook	9. Aim—release
4. Establish bow hand and arm	10. Aim—follow-through
5. Head up	
6. Raise unit	

The sign should be placed at the right end of the target line so that it is readable by the entire class at the shooting line. It may be helpful to have additional signs so that they can be placed at each end of the target line. Since a major cause of poor shooting is a deficiency in basic form, signs should be displayed any time there is shooting—whether it be beginning, intermediate or advanced.

Archery is a game of consistency, which is achieved through repetition. The 10-step poster not only reminds students of the sequence in the repetition but also serves as a helpful checklist for you. The order of the steps in the instruction does not follow the sign. There is a definite safety reason for this: the students should not be allowed to nock an arrow until they are actually ready to shoot.

You may also wish to create your own flip charts to emphasize each step. Other useful visual aids include slides, movies, student demonstrations, and videotape with instant replay.

INSTRUCTION PROCEDURE

This instruction is divided into six units. They are not necessarily designed to fit any given class period. It is up to the individual instructor to plan the time allotment. NOTE: *Directions will be given for right-handed shooters; left-handers should do the opposite.*

unit 1

The object of this first unit is immediate participation and immediate success. There should be no insistence on perfect form at this time.

Have all students line up at the shooting line (20 feet) and count off by fours. Assign the first group of four to shoot at target 1, the next four at target 2, etc. Ones and threes are Line A and remain at the shooting line; twos and fours are Line B and should step back about four steps. Both Lines A and B follow these instructions.

Place Quiver

Demonstrate the proper placement of the quiver by hooking the quiver at the right hip with arrow nocks forward (left-handed shooters should place the quiver on their left hip).

Position Tab

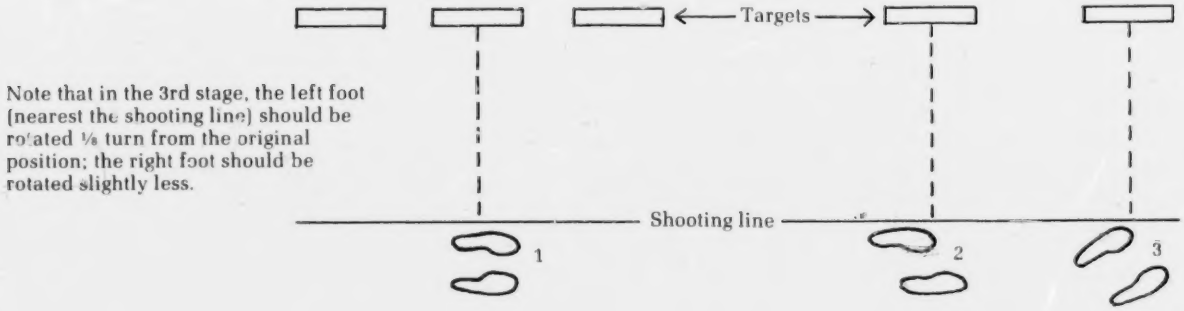
Explain and demonstrate the proper placement of the tab. Using the Marshall style tab, smooth side up, put the middle finger of the right hand down through the hole.

Position Arm Guard

With narrow end toward the left wrist, tell the class to center the arm guard on the inside of the arm between the wrist and elbow and fasten the straps.

Establish Stance

Have the students stand at a right angle to and with their left shoulder toward the target (left-handers should stand with their right shoulder toward the target). Weight should be evenly distributed and feet should be as wide apart as is comfortable (approximately shoulder width). This is the square stance. Instruct students to move their right foot forward, toward the person in front of them, until the instep of their right foot lines up with the toe of their left foot. Tell students to raise up on their toes and take a ⅛ turn toward the target. This is the oblique stance.



Note that in the 3rd stage, the left foot (nearest the shooting line) should be rotated ⅛ turn from the original position; the right foot should be rotated slightly less.

Figure 13. Establishing the stance. Square stance Oblique stance

The oblique stance is used because (1) it allows beginners to use the back muscles immediately; (2) it moves the string away from the bow arm so there is less chance of string slap; and (3) it gives the student a secure base.

Establish Bow Hold

Have each student extend his left arm toward the target with the left hand in a "handshake" position. Direct each student to grasp the lower limb of the bow with the right hand; place the pivot point of the bow handle (Figure 9, p. 12) in the "V" formed by the thumb and forefinger of the left hand; and drop the forefinger around the back of the bow with the thumb resting lightly over the forefinger. The other three fingers should be pointing toward the target.

Inform students that the pivot point should touch only the meaty part of the thumb and that no other part of the hand or palm should touch the bow. The extreme of extending the last three fingers toward the target will help the student keep the palm off the bow. This should result in a relaxed hold on the bow and avoid a "gripping" on the bow handle. The wrist should be straight, but relaxed. Have the student relax and hold the bow at his side with the string up so that the bow does not interfere with students on either side. Tell each student to raise his head, look at the bullseye, raise the bow arm to shoulder height, and lower again to the side.

Set a Hook

Without the tab in shooting position, demonstrate and have the class do a "Boy Scout salute" (with the thumb and little finger of the right

hand touching over the palm and with the other three fingers straight). Now have students set a hook by pointing the tips of the three string fingers toward the thumb. The students should hook the first three fingers onto the string at the nocking point so that the string lies in the crease made by the first joint of each finger.

The back of the hand should be kept straight—a cupped hand is incorrect. When the students draw, you will note that the pressure of the string will force the fingers to straighten slightly and this is correct. The Boy Scout salute is used to keep the thumb off the arrow, but as the students shoot for a while, the thumb and little finger will relax.

Practice Release

With the completed unit (bow hold, arm straight down at side, and fingers on the string), have the class raise head to look at the bullseye, raise both arms to shoulder level, and stop. Instruct class to draw the bowstring 1 inch, relax the fingers, and let the string roll off the fingers. If you tell the class "1 inch," almost all will draw 3 to 5 inches; if you say "5 inches," they will draw 15 inches.

Have students repeat this drawing and releasing of the string at least three more times or until most of the students have the feel of the release. This can be done while the bow arm remains in position so it is unnecessary to go through the whole routine of forming the unit each time.

Establish an Anchor

With the draw hand in correct position (but not on the string—Boy Scout salute in hook position), demonstrate and have the students hook the "V" made by the thumb and forefinger behind the jawbone. Students should lay the forefinger along the face so that the tip of the forefinger touches the corner of their mouth, with all three string fingers still in proper hook position. Another method: Tell students to look at the person in front of them; then, have them place the hook on their mouth and turn their head to look at the target. (This may help them locate the anchor position.) This is the high anchor.

Explain to the class that archery is a game of consistency and that the anchor point is one of the most important parts of consistency in shooting. An exact anchor establishes the velocity of the arrow, as the length of the drawn arrow will determine the number of pounds of the bow that are utilized. Consequently, if the bow were drawn 1 inch longer one time than another, it would impart approximately 2 pounds more energy to the arrow. Raising or lowering an anchor point will have the same effect on trajectory as raising or lowering the rear sight of a rifle.

Practice Draw

Prior to giving this instruction, tell the students that they should never let go of the bowstring at full draw without an arrow because the bow might break.

Have students assume the stance and establish bow hold, with the hook and fingers on the string (again not using the tab). Then instruct the students to straighten bow arm, raise their head, look at the target, draw to anchor, and *let down*. Line B may be used to check Line A, and vice versa.

CAUTION: *Never allow an arrow on the bow during this exercise.*

Repeat this several times. As the lines repeat the exercise, check the path each student's string is going to travel to be sure that there is string clearance to avoid string slap on the arm. With female stu-

dents be sure the string is on the outside of the breast. Some students will have a hyperextended elbow or for some other reason it appears that the string will hit the arm. This will be a minority of the students and they should be worked with individually. There are two common ways to eliminate this problem:

a. Tell the student to extend the bow arm at shoulder level toward the target; bend the bow arm at the elbow; bring the handle of the bow in to the chest; and re-extend the arm.

b. If this does not position the bow properly, have the student extend the bow arm toward the target at shoulder level and from the shoulder roll the whole arm, including the elbow and wrist, until the bow is horizontal to the ground. Then have the student straighten the bow with just a turn of his wrist without moving the rest of his arm.

Nock Arrow *Line A only:* With the bow hand in place and with the string against the hip, have the students take an arrow from the quiver, holding the arrow at the crest between the thumb and index finger. Instruct them to push the nock of the arrow onto the string just below the nock locator. The cock feather (odd-colored feather) should be away from the bow, and the shaft of the arrow should be lying on the arrow rest. Be sure that no student holds the arrow with the index finger of the bow hand. Pinching the nocks makes this unnecessary (p. 14).

Release Arrow Using the finger tab and with the arrow now in place, have the students re-establish the stance and set the hook on the string, with index finger above the nock of the arrow and the next two fingers below the nock. They should re-establish the bow hold, making sure the bow arm is straight at the side. Talk the students as a group through each of the 10 steps (p. 21). Have the students raise their head, look at the bullseye, raise the unit, stop (with elbow of the draw arm slightly above the plane of the arrow), draw to anchor, and release – thereby shooting an arrow.

Prior to the completion of this first shot, a very short explanation of instinctive aiming should be given but not dwelt upon. It is sometimes helpful to use an analogy, such as: shooting a bow instinctively is similar to throwing a baseball; concentrate and focus eyes upon the point you want to hit. Do not look at the arrow or bow, but *keep both eyes open.*

After shooting the first arrow, use the 10 basic steps and talk Line A through a second arrow. Have Lines A and B exchange places. Talk Line B through four arrows. Have Lines B and A exchange places again and talk Line A through their remaining two arrows.

Repetition is extremely important in teaching a person to shoot a bow. Talking the class through these first shots serves as a safety control and gives the students repetitious verbal direction.

If this procedure is followed, all students should have shot a minimum of four arrows in the first 30 minutes.

In these first few arrows the instructor should be concerned only that the student does not hit his arm and is able to hit the target. Perfect form is immaterial at this stage. Emphasis should be on immediate participation and immediate success.

Retrieve Arrows After all students have shot four arrows (six, if time permits), demonstrate and explain the proper methods of retrieving arrows from the target and ground. Explain the duties of the foursome in retrieving

arrows. Have each group assign: a *target captain* whose duty is to withdraw all arrows from the target; two *arrow receivers* whose duties are to record scores and receive the arrows as the captain withdraws them from the target; and an *arrow retriever* who retrieves arrows that missed the target.

It is each individual's responsibility to pick up all arrows he sees lying on the ground and give them to the arrow retriever. Caution the students to walk *slowly* to the target and watch for arrows on the ground. Demonstrate that an arrow buried under the grass should be withdrawn point first and be completely clear of the grass before the arrow is lifted.

Explain and demonstrate withdrawing arrows from the target. Have students place their left hand flat upon the target face with the arrow shaft close to but not touching the base of the "V" made by the thumb and forefinger. During this operation the person withdrawing the arrows should stand to the left of the arrow and lean slightly over the top of it. He should then grasp the arrow shaft with the right hand at a point closest to the left hand and the target, and pull the arrow straight out of the target, being careful not to bend the arrow shaft up or down, right or left.

> **Point of Safety:** Stress that no one stand directly in front of the target while arrows are being withdrawn.

The arrow receivers should not attempt to separate the arrows at the target. After all scores have been recorded and arrows are withdrawn, the receivers take the arrows to the shooting line before separating them and giving them back to the shooters.

> **Point of Safety:** The target captain is responsible for each member of the group. It is his job to remain in front of the target until all members of his group have started back to the shooting line.

If the target groups are fewer or more than four people, adjust the target assignments accordingly. After assignments have been made and the withdrawing of arrows has been demonstrated, have the students retrieve their arrows and return to the shooting line.

For the remainder of this unit the students should shoot as much as possible with a minimum amount of instruction. However, the instructor should talk the lines through at least the first arrow of each end.

unit 2

Have students shoot one end at 20 feet; talk them through the 10 steps for at least half the arrows.

Follow Through

Tell the students to continue to aim, with eyes focused on the bullseye, and bow arm and drawing hand still in shooting position for a count of two after the release. A good trigger phrase is "hold a pose," as for a picture. An analogy of the follow-through could be that of shooting a rifle. If, upon squeezing the trigger, the barrel is moved, the bullet will be thrown off-target in that direction. The same thing happens with movement in the bow arm upon release: if the bow arm is dropped, the arrow drops.

It is natural for the bow arm on a right-handed shooter to move slightly left and down on the release because of the sudden release of tension.

Have the students shoot an end concentrating on follow-through. It is recommended at this point to continue to talk the lines through at least one arrow of each end.

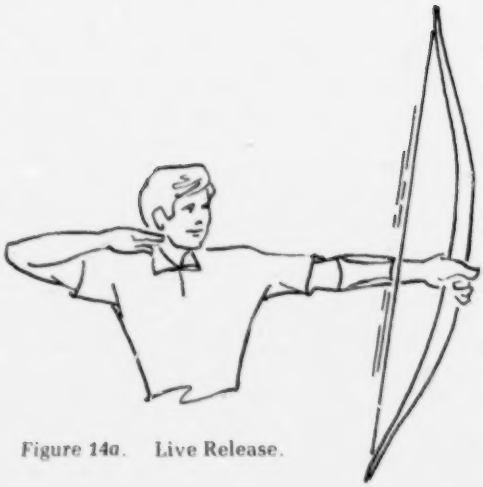


Figure 14a. Live Release.

Inform the class that while Line A is shooting, the corresponding target members on Line B will act as student coaches; similarly, when Line B is shooting, Line A will act as coaches. If there is room, each student coach should stand on the shooting line facing his corresponding shooter. If there is not room on the shooting line, each coach should stand behind and slightly to the side where he can watch the shooter's anchor, release, and bow arm. This system enables the instructor to have better control of the class and keeps all students occupied. It also gives the student coaches a better perception of their own shooting.

The student coach's job is to remind the shooter to concentrate on the 10 basic steps. The coaches should be cautioned to offer suggestions to the shooter only between arrows, not while the shooter is at full draw. They should also be cautioned never to reach through the string. The student coach/shooter relationship affords an optimal learning opportunity.

The remainder of this unit should be spent in practice to acquaint students with the student coach situation, with emphasis on each of the 10 steps, including follow-through.

unit 3

Begin the class by shooting one end at 20 feet.

Release

Figure 14b. Action of the live release (idea of "strong man" pulling on back muscles).

Explain and demonstrate the live release. A live release is a normal reaction of the drawing hand moving back, with the string rolling off the fingers as they are relaxed. This hand reaction is caused by the back muscles and not by pulling the fingers off the string. Emphasize that the release remains an action of relaxing the fingers and letting the string roll off, and that the natural reaction of the back muscles pulling together will cause a slight backward movement of the drawing hand and a slight downward and outward movement of the bow hand.

An excellent way to demonstrate the action of a live release is to place the drawing hand in anchor position, invert the bow hand, and hook the three fingers of the bow hand in the three fingers of the drawing hand. Holding the drawing hand in anchor position, start pulling the hands in opposite directions and transfer the pull to the back muscles.

Figure 15. Exercise to demonstrate live release.

Have the students shoot one end, concentrating on live release. Utilize student coaches. Spend as much of the remaining time as possible shooting while concentrating on and repeating the basic 10 steps. Reserve enough time to teach the students how to unstring and string a bow.

String and Unstring a Bow (Step-Through Method)

This method is the only safe method to use without the aid of a mechanical bowstringer. (*It is strongly recommended that commercial bowstringers be considered in the program.*) Caution students that improper use of the step-through method will twist the limbs of the bow and could cause the bow to break.

1. Have students check to make sure that the bottom loop of the bowstring is properly seated in the string groove on the lower limb. A rubberband stretched around the string and bow will hold the lower loop in place.
2. While the students are holding the bow by the upper limb in their right hand, tell them to look at the position of their right foot; step across the bow with the right leg; and return the right foot to the same position.

Figure 16. Stringing the bow.

3. Instruct them to lay the curve of the lower limb over their left ankle. With the lower loop in place, have them hold the string taut in their left hand.
4. Then have the students place the handle of the bow under their right thigh, keeping the right knee slightly bent.
5. The students should place their right hand beneath the curve of the top limb—palm open. The bow should rest across the palm and base of the thumb, the elbow held high.
6. Have the students keep their left leg straight; raise their left heel off the ground and outward; and push forward with the right hand while locking the right knee so that the bow bends naturally.
7. The students should then slip the top loop of the string into place and relax—*slowly*.
8. Have the students check to see that the string is seated properly in the nock before releasing the tension on the bow.

To unstring the bow, just have the students reverse this process. It is a good idea to string and unstring the bow several times until it becomes easy and natural to do. From this point on, stringing and unstringing will be done by the students at each session.

unit 4

Have the students shoot one end at 20 feet; talk them through at least one arrow. After the first end, move the class to 15 yards.

Aim — Pre-Gap (or Pre-Draw-Gap) Method

This is a method of teaching the student to shoot without a bow sight, and is an aid for teaching instinctive shooting. The principle behind it is that it sets the shooter's arm on a plane with the target and in proper position so that at full draw his concentration can be entirely on the spot he wants to hit. It is important after the pre-gap spot is established and the unit is set that nothing moves except the draw to anchor. The bow arm must remain as steady as possible. The pre-gap spot does not have to be exact because the shooter's instinctive ability will take over as he holds at full draw and concentrates on the target. He will instinctively make the minor adjustments necessary. The pre-gap method is not an end in itself, but the basic mechanics of the method give the students security in learning instinctive shooting.

Talk the students through the first six basic steps in shooting, raising the unit. (1) Then have them look across the point of the arrow to a predetermined spot. If students stand 15 yards from a 36-inch target with a 20- or 25-pound bow, a spot at the base of the bale will usually enable them at least to hit the target. It is important that they get the sensation of "being on the spot." Have the students maintain bow arm position and body position. (2) Tell them to shift their eyes to the center of the bullseye and concentrate on the center, holding as steady as possible. (3) Next have the students continue through the dynamic steps of shooting—draw to anchor, hold, release, and follow through—maintaining body position and bow arm position until after the arrow has hit the target.

Help the students to adjust the predetermined spot by having them note where the first arrow entered the target. If a student's arrow was high, tell him to lower the spot; if his arrow was low, tell him to raise the spot.

Continue to talk students through this method, arrow by arrow, for at least two ends. Remind them to shift their eyes to the bullseye prior to the draw. On the third end explain to the students that they can see the point of the arrow in their peripheral vision while keeping their eyes on the center of the target. Have them set their pre-gap

spot without looking directly at the arrow, using only peripheral vision. Continue to practice this procedure.

unit 5

Begin the class by shooting one end at 15 yards using the pre-gap method. Remind students that regardless of the distance or the method of aiming, the basic form does not change. After the students have shot the end, have them go to the 20-foot line. Each bow should be equipped with a bow sight or a large-headed pin to be placed under the tape on the back of the bow.

Aim — Sight Method

Prior to class, sight-in one bow with a 26-inch arrow and note the placement of the pin. This placement should be translated into inches from the arrow shelf.

Explain the placement and use of a sight. Have students place the pin in the tape at the predetermined distance from the arrow shelf, with the head of the pin projecting approximately 1 inch from the same side of the bow as the arrow.

Figure 17. Use of pin-type bow sight.

Proceed with the usual basic steps. After raising the unit have the students close the left eye, and using the right eye, center the pin on the center of the bullseye. Draw to anchor. Hold the pin as steady as possible on the center, and then release and follow through.

Let Lines A and B each shoot one end in this manner as long as the arrows hit somewhere on the target. Before retrieving arrows explain sight adjustment. Have the students reset their pins according to their group of arrows. A simple way to demonstrate movement of the sight is to adjust the sight in the same direction as the error. If the group is high, move the sight up; if the group is left, move the sight to the left, and so on.

Have students retrieve their arrows and shoot a second end with the new sight setting. Once a sight is positioned for success at a given distance it should be marked for each individual shooter.

Have students retrieve their arrows and go immediately to the 15-yard shooting line.

Draw Low Anchor

Explain the low anchor. Follow the basic steps of shooting through Step 6. Take the students through the first six basic steps of shooting. Then with the drawing hand and arm at shoulder level, and with both eyes on the center of the bullseye, instruct students to raise the head slightly until the skin of the neck is tight. Have them draw the bowstring toward the throat directly underneath the *left eye* until the thumbnail of the drawing hand lies lightly on the Adam's apple. They should then turn the head to the left, and place and center the chin on the string. Instruct the students to lower the head until the chin rests on the drawing hand, and place and center the nose on the string. Have the students relax the slightly cupped little finger of the drawing hand and allow it to drop down and lightly touch the neckline clothing. They should continue to maintain tension in the drawing elbow and proceed with Steps 8, 9, and 10 of the basic steps of shooting an arrow.

Have students practice this draw and anchor several times before shooting an arrow. As the students practice this anchor, check the draw arm elbow position. Many students will let this elbow drop down, making the draw to anchor and holding difficult. Correct this as recommended in "Teaching Tips" (no. 26, p. 31).

Have the students shoot an arrow with an under-the-chin anchor from 15 yards using the same sight setting as with a high anchor at 20 feet. If a student hits the target on the first arrow he should retain the

same sight setting and shoot the remainder of his arrows. When he has finished shooting his arrows, he should then readjust the sight setting as above.

The remainder of this unit should be spent on practicing sight shooting with the low anchor. At the end of this unit reserve enough time for a short discussion period. Inform the students that they have been exposed to two different types of anchor—low and high (p. 23): and two different methods of aiming—instinctive and sight; and that from this point on they should choose the methods of anchor and aiming that they prefer, stick with them, and develop their form.

unit 6
Shoot a Competitive Round

Listed below are two rounds that are adaptable to instructional use. In conducting a competitive round or tournament, two practice ends should be allowed before the scoring begins. The purpose of these rounds is to expose students to the mechanics of a tournament. The scores might be used as a part of the skill evaluation.

Instructional Round I

Distance: 20 yards

Target: 36-inch, 4-color face

Total arrows: 60 (5 arrows per end; 4 ends per game; 3 games per round)

Score: 5-4-3-2-1

Total points: 300

Instructional Round II (American Archery Council Instructional Round)

(1) *Modified Chicago Round*

Distance: 20 yards

Target: 36-inch, 4-color face

Total arrows: 30 (5 arrows per end; 6 ends per game; 1 game per round)

Score: 5-4-3-2-1

Total points: 150

(2) *Modified Flint Round*

Total arrows: 30

Score: 5-3

Total points: 150

Station 1 4 arrows at 17 yards - 18-inch B&W face

Station 2 4 arrows at 20 feet - 12-inch B&W face

Station 3 4 arrows at 20 yards - 18-inch face

Station 4 4 arrows at 14 yards - 12-inch face

Station 5 4 arrows at 15 yards - 18-inch face

Station 6 4 arrows at 10 yards - 12-inch face

Station 7 1 arrow each at 20 yards, 17 yards, 15 yards, 14 yards, 10 yards, 20 feet - 18-inch face

Total points for Round II: 300

TEACHING TIPS

1. Put the bow in the student's hand as soon as possible so he can understand the tool while basics are explained.
2. Be sure to check for pins, loose sleeves, etc., on the bow side of the student before allowing him to shoot.
3. Check the student's finger tab closely before he shoots. There may be a tendency not to put it on all the way.
4. Watch for four fingers on the string. Often a student will use the little finger on the draw hand, and it is difficult to spot.
5. Look for cramped fingers on the bowstring. Students frequently point the fingers down rather than horizontally, which causes the arrow to stay on the string but not on the bow.
6. Watch the thumb on the drawing hand. Students tend to push the nock as they place the fingers on the string. Correct this early and often until the fault is eliminated.
7. If a student masters the draw and anchor quite readily, stand behind him and check the string path before allowing him to shoot. Never allow a student to hit his arm.
8. Let students shoot the first arrow as soon as possible, even if the bow hand, anchor, draw, etc., are not good. Work on these aspects *after* they have shot a few arrows.
9. The tone of the instructor's voice will convey many things, both good and bad. Try to keep an enthusiastic approach in your voice and actions.
10. Use a positive approach in all instructions. Minimize the use of the word "don't." Use praise sincerely whenever possible.
11. Usually it's best to avoid emphasizing what a student is doing *wrong*. Suggest a correct way to him.
12. The first time a student hits the target, he is very proud of his accomplishment; be sure to praise him.
13. Before making a correction, analyze the student's fault to find the cause. Often the cause is hidden by the obvious effect of the error. A good example is bow arm movement. Many times this is caused by a forward release, but to the self-styled shooter the error is simply a moved bow arm.
14. Never correct a student after spotting a fault on one arrow shot. Watch him shoot several arrows so that the cause of the fault may be determined and then correct him.
15. Don't over-instruct. The more you talk and bring up various problems, the more confused the student will become.
16. Stick to the 10 basic steps in shooting and repeat them constantly. Repetition will make the student comfortable.
17. It is permissible and correct to draw a bow without an arrow to demonstrate a shooting technique to the class. However, when this is first done, caution the students about the danger of drawing a bow when someone is standing in front of them and the possible result of an accidental firing of a dry bow.
18. Demonstrations of the component skills are useful in instruction; however, don't demonstrate your personal shooting ability, especially in the beginning stages of a class.
19. When demonstrating techniques to the class, be sure to perform them correctly. People tend to imitate, and anything the instructor does in class automatically becomes an accepted method by the students.

20. Use problems as they develop to your instructional advantage. For example, if an arrow hits the target but hangs down, stop the whole class and explain the rule.

21. A common fault with beginning students is the falling of arrows from the arrow shelf. The slipping is caused by the fingers rolling the string away from the bow. By taking a slightly deeper hook on the string and securing the string in the crease of the first joint, the resistance of the bow weight while drawing will cause the fingers to straighten slightly and roll the string in toward the bow, thereby holding the arrow on the shelf. If this problem persists, demonstrate and explain the student's own control of the arrow. This is done by intentionally rolling the string hand and bending the wrist away from the bow to take the arrow away from the shelf; then bring it back by straightening the wrist. Repeat this procedure two or three times.

22. In most cases, on the practice draw students automatically twist the upper trunk while holding the bow shoulder and bow arm in correct position. However, in some cases, particularly in women, the tendency is to draw the bow without twisting the top half of the body. In this case, stand facing the student when she is in position just prior to the draw. The bow arm should be extended toward the target and the fingers should be on the string. Ask the student to start the draw to anchor. As the student draws, put one hand on either side of her waist and lightly twist the top half of her body to the right. In most cases, this will immediately eliminate the problem, but occasionally it may have to be repeated two or three times. This correction is also used when a female student continually draws the string to the inside of the breast.

23. The elbow of the drawing arm should be higher than the plane of the arrow upon beginning to draw, through and including the follow-through.

24. In the follow-through, tell the students to "pose" and continue to aim, with the eyes focused on the center of the bullseye.

25. If a student has a release problem, have him relax the small finger and thumb of his drawing hand.

26. Use the point of an arrow to touch lightly the student's elbow when he has a tendency to collapse the elbow. This will cause him to pull harder immediately and raise the elbow.

27. Caution the student coach not to put his hand or any object such as an arrow through the area between the drawn string and extended bow hand.

28. If a student's hand remains at his face upon release, he is not pulling, but is plucking the fingers off the string.

29. Don't over-emphasize movement of the bow arm.

30. You can easily see if any arrow will completely miss the target on the first arrow during the pre-gap instruction by standing at the side to look at the angle of all arrows while students are at a practice full draw.

31. Stress consistency of form. Form does not change regardless of distance, method of aiming used, or type of activity (including archery games).

32. Instruct students to keep the little finger close to the neck or clothing at anchor point.

TESTING AND EVALUATION

Students' proficiency and knowledge of archery can be evaluated by skill and written tests. Important phases of archery that should be tested are:

- Safety rules
- Basic 10 shooting steps
- Location of nocking point
- How to string a bow
- How to score
- Two methods of shooting
- How to determine arrow length
- How to determine bowstring length
- Shooting form and accuracy
- Archery etiquette and terminology

One college instructor uses the following grade distribution: Knowledge—30 percent; Shooting skill—30 percent; Shooting form—30 percent; Attendance, attitude, etc.—10 percent. Progression also should be considered.

Skill Test

To ascertain shooting form and accuracy, a skill test is appropriate. To determine accuracy, a score should be given for a certain number of arrows. Charting each student's score every time the class shoots for score will indicate to the student his progress. To determine shooting form, the instructor can test the students' performance of the 10 basic shooting steps. He might wish to use a checklist with columns for "Stance," "Nock," "Draw," etc.

Written Test

Each instructor should make up his own written tests based on the material covered in class. The following are sample test questions.

T F 1. The single most important phase in archery is consistency.

T F 2. To raise the arrow in sight shooting you lower the sight.

T **F** 3. The anchor point should vary according to the elevation of the target.

T F 4. The drawing elbow should be above the arrow level when the shooter is at full draw.

T F 5. When the whistle is blown once and the shooter is on the shooting line he may then nock his arrow.

6. The (oblique) stance is used in class.

7. To practice (instinctive) shooting you can use the pre-gap method

8. The bow moves to the (left) and (down) after the release.

9. The odd-colored feather on the arrow is the (cock) feather.

(e) 10. To release the string, allow the fingers to do what?

(c,g) 11. What are the two important reasons for a consistent anchor point?

(f) 12. The arrow forms what angle with the string?

(a) 13. A sight is used with this method of shooting.

(h) 14. What muscles are used to relieve the pressure on the drawing arm?

a. free style
b. instinctive
c. rear sight
d. forearm
e. relax
f. right
g. velocity
h. back

15. List, in order, the 10 basic steps in shooting an arrow.
16. What are the reasons for using the oblique stance?
17. Describe the action of the drawing hand upon release and follow-through.
18. How can you determine if you should shoot right- or left-handed?
19. Explain how to establish the high anchor point; the low anchor point.
20. Upon establishing your gap in instinctive shooting, your eyes should focus upon:
    a. point of arrow
    c. nock of arrow
    b. center of the target
    d. all of these
21. The third basic step in shooting an arrow is:
    a. straight arm
    c. draw
    b. nock arrow
    d. set hook
22. The bow should be held in the handshake position with:
    a. all fingers extended
    b. all fingers extended except index finger and thumb
    c. only thumb and index finger extended
    d. none of these
23. When establishing the deep hook, the thumb touches:
    a. the little finger
    c. the middle finger
    b. the ear
    d. the nock
24. The important reason for the oblique stance is:
    a. balance
    b. to prevent the string from hitting the bow arm
    c. to allow the shooter to use back muscles
    d. all of these

SAFETY POINTS

The following safety points are important in archery and should be an integral part of the basic instruction.

1. Be sure students wear shoes on the archery range at all times.
2. Emphasize that a "loaded" bow is a deadly weapon.
3. Caution students never to show their skill as archers by using a human target or by permitting anyone to hold a target for them.
4. Allow students to shoot only at targets.
5. Caution students to use care in handling and carrying equipment and not to run with arrows held in the hand
6. Explain to students that one member of a target group should always stand in front of the target while others are looking for lost arrows. If alone, an archer should place his strung bow in front of and across the face of the target to indicate that someone is behind the target.
7. Inform students that in field archery "Timber" should be called prior to shooting. Those who are walking away from the target at a distance should also be warned.

8. When an arrow or bow falls in front of the shooting line, caution the student to wait to retrieve it until the persons on each side of him have completed shooting. If the bow or arrow can be reached without stepping across the shooting line, the item may be retrieved and shooting continued. An arrow that falls out of reach is considered shot. During a class it is best to blow the whistle to stop the entire class and have the student pick up his equipment.
9. If an arrow is hanging on the target, blow the whistle to stop the class, remove it from the hanging position, and insert it back into the target in the correct scoring area.
10. Caution students always to keep a safe distance behind (or to the side) when arrows are being withdrawn from the target. An arrow suddenly jerked out of the target could cause severe injury.
11. Never use imperfect or inferior equipment, such as cracked arrows, arrows with fletching or point missing, cracked bows, or bows with frayed strings.
12. Caution students never to shoot arrows that are too short.
13. Be sure that students always use an arm guard and finger protector.
14. Be sure the archery range is supervised whenever shooting is under way.

ARCHERY ETIQUETTE

With beginning shooters several courtesies should be established. They include the following items:

1. Don't talk to or disturb shooters on either side when they are shooting.
2. Be careful of bow movements; avoid any "jabbing" of your neighbors.
3. Avoid loud laughter or talk behind the shooting line, as beginners sometimes mistake it for personal criticism.
4. Stay at the shooting line until your target partner has shot his last arrow, then step back together. (It is much easier for your partner to shoot his last arrow when he is not the only one on the line.)
5. Never shoot another person's personal bow. You may overdraw without realizing it, damage the cast of the bow, or break it. Besides, it is his "pride and joy" and very private.
6. Be sincere when counting score—always be a good sport.

correlation of
archery instruction
with other interests and study areas

Instruction in archery has great potential for correlation with other areas of study in the school curriculum, and with other program activities in camps, recreation agencies, and organizations. While archery skills and games are usually taught in physical education and recreation classes or through clubs, after-school programs, and camping and recreation activities, there are many aspects of archery which are appropriate in other areas of study. The history of the sport, the mechanics involved, the equipment used, and the health and exercise value can serve as content and motivation in a variety of programs. In schools, particularly, there are unique opportunities for team teaching in cooperative units involving archery instruction with other subject matter areas. While space does not permit a detailed description of all the possible relationships to other subjects and activities, a few examples are suggested below.

English and literature:

- Greek mythology related to the constellation Sagittarius
- Robin Hood story
- William Tell play
- James Fenimore Cooper books
- Reports and themes on some phase of archery

Art:

- Sculpture and drawings related to archery—form and design
- Posters and signs illustrating forms and techniques
- Designs for camouflage in hunting
- Diagrams of bows, flight of arrow

Industrial arts and crafts:

- Building storage racks
- Making tackle items, instructional charts
- Repair of arrows
- Indian crafts, such as cordage

Science and math:

- Arrowheads
- Use of wood and glass
- Flight of arrows
- Velocity, angles, leverage

Social studies:

- Relationship of archery to history of man and events
- Indian history

Health and physical development:

- Effect on posture
- Muscle development
- Self-discipline
- Release of tension

archery games

Tic Tac Toe

Place three rows of three balloons on a target matt. Divide the group into two lines, A and B, and have them stand in a single file 15 yards from the target. If the group is under 14 years of age, a distance of 20 feet is sufficient. Each group will have a captain who will be responsible for indicating to each team member which balloon he should shoot. At the signal to shoot, each captain will shoot one arrow and step back. The second and each succeeding person will shoot—one at a time—when ready, then go to the back of the line. The first team to break three balloons in any line is the winning team.

Point of Safety: No one should be allowed to take an arrow from his quiver until he is standing on the shooting line.

Wand Shooting

Place a strip of 1-inch masking tape over the target face from top to bottom. The group is divided into teams as for Tic Tac Toe and the shooting rules are the same. A game is the best two out of three points. A point is scored when an arrow hits the tape anywhere on the target. When an arrow hits or looks as if it has hit, the range captain will blow his whistle and call the arrow. When a team has scored two points, it is declared the winner.

Bird Shooting

Flu flu arrows are needed for this game, along with at least six commercial bird targets or 16-inch circular discs cut from heavy cardboard. Two teams are lined up as for Tic Tac Toe . The bird thrower should be to one side of the shooters and hidden from view if possible. When the two teams are on the line with arrows nocked, the range captain calls "Pull." The bird thrower can throw the bird at any time within 20 seconds after the call and at any elevation or angle. It is suggested that the birds be thrown across and in front of the shooters at a distance of no more than 10 yards. Each member of both teams should have at least three shots. Any hit (determined by the range captain) scores one point. The team with the highest score wins the game.

Clout Shooting

This is not a regulation clout. The distance is 90 yards from the shooting line to the center of the target. Drive a 5-foot wooden stake into the ground for the center of the target. Attach a large (12-inch diameter) brightly colored balloon to the top of the stake as a marker. The clout is then scored and shot like a regular clout except that only four ends are shot. The competition is between total team scores. Any team that breaks the balloon gets an additional 50 points added to its

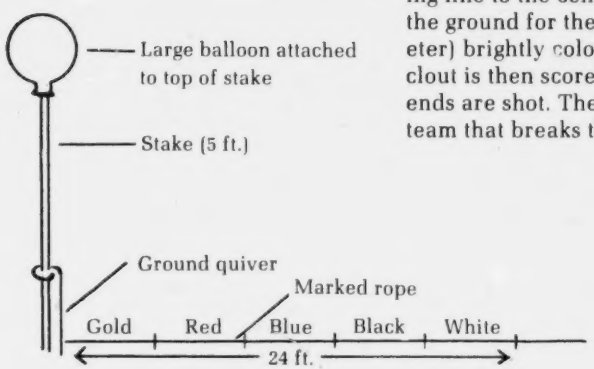


Figure 18. Clout target and scoring rope.

total score. Rope can be attached to ground quiver. The stake can then be removed when scoring, thus allowing the rope to rotate more easily for more accurate scoring.

Rabbit Shooting

Flu flu arrows and balloons about 6 inches in diameter are needed. This game can be played only if there is some breeze. The teams are lined up as in Tic Tac Toe. An assistant is placed on the upwind side of the shooters. Upon a hand signal from the range captain, an assistant releases two balloons so that they will blow across about 15 yards in front of the shooters. After releasing the balloons, the assistant moves back quickly. The shooters may not shoot until the range captain blows his whistle, which he does as soon as he feels the assistant is out of shooting range. When the range captain blows his whistle again, all shooting stops. Sometimes it is possible for three or four people to shoot before the balloons are out of range. When one or both balloons are either broken or out of range, the range captain stops the shooting and has the assistant release two more. A time limit may be set, or the game ended when a certain number of balloons have been released. The team with the highest number of hits wins the game.

Roving Archery

Small groups of roving archers pick targets randomly at varying distances (such as a bush, clump of grass, or old stump) and each shoots one arrow. The archer who hits the target or comes closest earns one point and chooses the next target. The winner is the archer with the most points.

The improvement of an archer's shooting skill is one of the elements that keeps an archer active. This is accomplished by developing a program that includes practice, individual instruction, and competition. Such a program requires an expansion of the basic group instruction for beginners. After an initial exposure to archery through group instruction, the individual has an awareness of basic shooting techniques and archery equipment. This section provides additional information for the archer and instructor in the understanding of why, how, and when certain functions of the archer or the equipment are important.

How do you attempt to answer the many questions about archery? What class or program will insure success for the teacher-coach or the archer? This section of the planning guide is just that—a *guide*. Your program is unique from all others. Thus, you should adapt and adopt those areas that will give your students the skill and knowledge that is desirable for your program. Ultimately, the archery student will determine the usefulness of the content.

INTERMEDIATE INSTRUCTION

equipment

TYPES, SPECIFICATIONS, AND FUNCTIONS

Bows

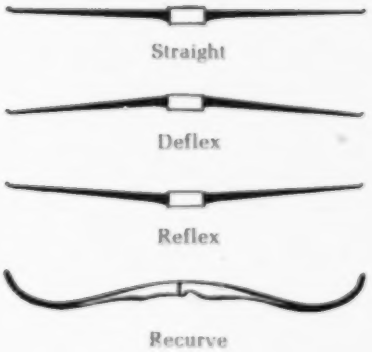


Figure 19. Bow limb configurations.

The Archery Manufacturers Organization (AMO) has set standards for bow lengths. Previously, not all bows of a given length used the same length string. Since the introduction of the AMO standards, all bows of a given length currently sold by any manufacturer utilize the same length string. Rather than having to buy a string by its actual length, these standards are set so that strings can be sold according to the length of the bow for which the string is being purchased. For example, a bow that is marked "AMO Standard 66 inches" requires an AMO Standard 66-inch string. This standardization should be extremely helpful to the archery instructor since it will eliminate the confusion of determining the correct string length for the bow.

Bow design.

There are four basic variations in bow design in terms of limb configuration: straight, deflex, reflex, and recurve.

Bow makers (bowyers) strive for the ultimate combination of speed and stability in a bow. The following are some general principles of bow construction:

1. The shorter, heavier weight bow, whose prime purpose is hunting, is built primarily for speed of arrow flight rather than for stability. A shorter bow will shoot faster than a longer bow of identical limb design and weight because of the distance of bow tip travel and the fact that more of the limb is used in thrusting the arrow.

2. The longer, lighter weight bows are designed for competitive shooting and the materials, specific limb design, etc., are aimed at achieving a perfect balance of speed and stability.
3. The intermediate length bows (usually lightweights) are designed for recreational use and therefore both speed and stability are sacrificed in the attempt to bring to the public a reasonably priced, all-purpose bow.
4. A reflex limb design will cause a bow to be faster but less stable than a deflex bow of identical length and weight. The more reflex that is designed into a bow, the faster the cast (bow speed).
5. The deflex design gives much more stability but less speed.
6. The combination of deflex and recurve provides a greater stability (because of the deflex) as well as more speed (because of the recurve).

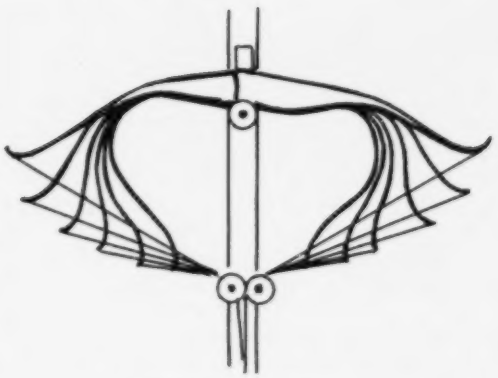


Figure 20. Hinges.

Bow limbs remain relatively constant in length. The difference in bow lengths is in the riser section of the bow and the design of the reflex, deflex, and/or recurve. The pressure that is absorbed by the bow limbs is quite high. When drawing a bow, the limbs (on a recurve) are straightened out and the pressure at certain points on the limbs—called hinges—reaches terrific proportions. A 40-pound bow drawn to 28 inches would have compression of approximately 180,000 pounds per square inch on the face of the bow and tension of approximately 135,000 pounds per square inch on the back of the bow. As the string is released, the pressures reverse themselves and the bow material must continually absorb this punishment. This clearly illustrates the elasticity and recovery qualities of the materials used in a bow.

This should also give a clear understanding of why a bow should never be shot without an arrow. The arrow helps absorb some of the pressure. The bow, if shot without the arrow, might otherwise continue to bend beyond its recovery position, snapping the string and limbs. Such an accident would be disastrous to the bow and hazardous to the archer.

Bow materials.

A bow shoots smoothly or roughly because of the materials used and how they are integrated into the bow design. The better and smoother shooting bows are composed of wood and fiberglass laminations. The predominate wood used is maple and both laminations (wood and fiberglass) are tapered on the better shooting bows. This produces speed while retaining smoothness.

Stacking is the excessive build-up of drawing weight. It is affected by both the design and materials utilized in the bow construction. Drawing weight will vary approximately 1½ to 2 pounds per inch. A bow measured at a 28-inch draw and marked at 40 pounds would be considered smooth if at 29 inches its draw weight was 42 pounds; if it increased to 48 pounds in 1 inch, this would be excessive stack.

Bow weight.

All bows unless otherwise marked are measured at a 28-inch draw. Consequently, an archer drawing more or less than the 28 inches will vary the draw weight by approximately 1½ to 2 pounds for each inch the draw length changes.

Using the AMO formula, the actual draw weight can be determined as follows: Divide the bow weight at 28 inches by 20; multiply by the number of inches the draw length differs from 28. Subtract or

add this amount to the bow weight at 28 inches, depending upon whether the draw length is shorter or longer. Examples:

1. Bow weight = 42# at 28"

   Actual draw length = 25.5"

   42 ÷ 20 = 2.1# x 2.5" = 5.25#

   42 - 5.25 = 36.75# at 25.5" draw length

2. Bow weight = 38# at 28"

   Actual draw length = 30"

   38 ÷ 20 = 1.9# x 2" = 3.8#

   38 + 3.8 = 41.8# at 30" draw length

Bow weight must be considered when selecting arrows with correct spine.

Bowstring height.

The string height (formerly, brace height) is established by measuring from the base of the throat of the bow or the pivot point. If the string height is not given by the manufacturer, a new bow should be strung, and the string height measured and noted (preferably marked on the bow handle with a felt pen). For an old bow, contact the manufacturer for recommended string height. String height may be changed slightly by twisting the bowstring. A dacron-base string may be twisted one-third of a turn per inch, or generally up to 12 or 14 turns maximum. Always twist in the same direction as the string has been twisted. If it is a homemade string with no twists, twist in the same direction as the serving is twisted.

The archer should know that there are various grades of dacron. The more expensive, professional grade dacron has virtually no stretch and is a third as strong as the cheaper grades. Because of its additional strength fewer strands are needed, which makes it faster.

How does string height affect arrow flight? The height of the string determines the speed of the bow. The higher the string height, the slower the arrow will travel. The lower the string height, the faster it will be. The action of the recurve is suppressed if it is overstrung; this is called dampening the speed of the bow. An understrung bow will increase the speed of the arrow, causing more erratic shooting and wider grouping. It will also cause the bow to shoot noisily. In tuning a bow, many archers know through experience the sound of their bow so well that they can tell by the sound when the string is letting down.

Stabilizer.

Stabilizers add weight to the bow thus helping to eliminate torque. Regardless of the anchor, when the archer is shooting a bow he is in a triangular position. The string, upon release, will attempt to realign itself with the bow hand, causing the bow to twist or torque every time an arrow is shot. The stabilizer does not eliminate the torque, but simply slows it down to enable the arrow to clear the bow before the torqueing action can affect the arrow flight.

The length and weight of the stabilizer will vary with the individual archer, his arrow length, and shooting style. Similar results of torque elimination can be accomplished by adding weight to the bow handle just below the hand.

Nocking point (Nock locator).

The nocking point should be a little high (about ⅛ inch above the 90 degree mark) so that upon release the arrow is forced to lift. The

arrow stays on the rest only 2 to 3 inches; from that point it starts lifting and bending.

The nocking point is ⅛ inch above the 90 degree mark to push the arrow down on the rest, which actually causes the lift. The arrow then rises, bending out or around the bow. The bending of the arrow during flight is known as the *archer's paradox*. Thus, the feathers do not hit the rest but move out and around the bow. The longer the arrow is on the rest, the less control the archer has over the arrow. Ideally, at the moment of release, the arrow would jump completely off the rest.

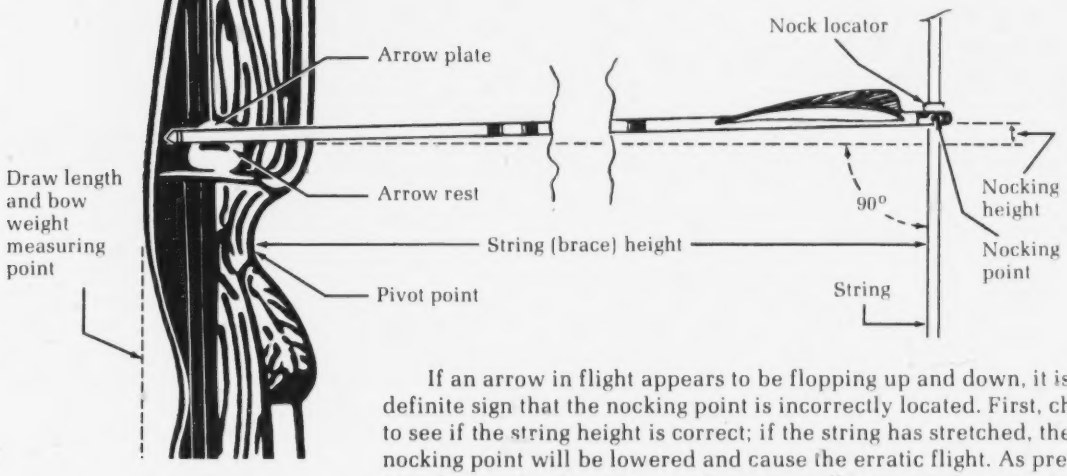


Figure 21. Detail of nocking point.

If an arrow in flight appears to be flopping up and down, it is a definite sign that the nocking point is incorrectly located. First, check to see if the string height is correct; if the string has stretched, the nocking point will be lowered and cause the erratic flight. As previously stated, a few twists in the string will bring up the string height and correct the nocking point problem. If this is not the cause, then remove the nock locator, make a pencil mark on the string, and shoot arrows until the proper nocking point is established by correct arrow flight.

For finer nocking point adjustment, stand 8 feet from the target (which establishes the arrow point approximately 6 feet from the bale) and shoot arrows at a target level with the height of your bow at full draw. If the shafts are parallel to the ground, the nocking point is correct; if the nock is higher than the point of the arrow, the nocking point is too high; and if the nock is lower than the point, the nocking point is too low.

Arrow rest.

All laminated, center-shot bows today have an arrow shelf created by the sight window. For consistent arrow flight there should be minimal contact below and to the bow side of the shaft. This is particularly necessary in lightweight bows used for tournament shooting, recreation, or instruction because the lighter the weight of the bow the slower the arrow travels. This means that the shaft will remain in contact with the rest and pressure point for a longer period of time, increasing the possibility of the shooter's bow hand movement affecting arrow flight. This situation becomes less critical as the bow weight increases, so that in the case of a hunting bow it is possible to shoot from a relatively large rest adhered to the shelf.

The arrow rest helps to clear the feathers from the shelf. Some bows have a solid shelf which causes drag and doesn't give the arrow enough lift to clear the feathers. This can be seen in the wear on the feathers after several ends are shot.

What is needed is "point contact" where the arrow shaft rests on a small area against the bow at a small contact area. Ideally, two pin heads—one sticking up from the shelf and one out from the bow window—would be close to a point contact arrow rest. This would give a very small area of contact with the arrow.

Determining the correct position of the pressure plate (point contact on the box window) requires some experimenting with your arrows. An arrow does not fly out of a bow in a straight line; because of the mass weight and sudden thrust against a linear object (arrow), the arrow bends. Thus, the archer's paradox is one reason for the spine testing of arrows and matched arrows. (See section on Arrows, p. 43.) This bending must be considered when placing the pressure plate at a certain distance from the surface of the bow window. Arrows matched to the bow will straighten out after traveling 6 feet.

One of the best ways to check the pressure plate position is to use aluminum arrows without feathers. Aluminum arrows are used because they are the most perfect arrows. Shoot the arrows into the target in the same way as described for establishing correct nocking point (p. 41). As the arrows strike the target at an angle, move the pressure plate out (some bows have a movable pressure plate) or build it up. This can be done by placing tape over a matchstick, building up layers of glue, or using a similar method. Some pressure plates are plastic and can be bent to a new position by warming the plastic. Shoot directly into the target and note the angle at which the arrows group. If the arrow nocks are angled to the left, move the pressure plate out; if the arrow nocks are angled to the right, move the plate in. Continue the adjustment until the arrows hit the target straight. When the bow is tuned properly the archer's paradox is minimal.

Most bow windows are cut past the center of the bow, which helps the arrow flight. The more expensive bows have adjustable arrow rests and pressure plates as standard equipment.

Bow sight.

A bow sight is essential for good shooting. Bow sights come in a variety of styles and costs. The four main types are: pin, post, peep, and cross hair. Individual preference will determine the type and its placement on the bow. The placement on the back of the bow seems most prevalent for short distance shooters, and placement on the face seems to prevail for longer distance shooters, allowing for higher elevation of the bow at long distances.

When the bow sight is on the back of the bow, some archers prefer a sight extension which moves the sight away from the archer. The farther the sight is from the archer, the more eye relief he gains and the better able he is to bring both the sight and the target into focus. To illustrate, bring your index finger near your eye and focus; then hold it away from your eye and focus. CAUTION: *The farther out the sight is extended, the greater the bow movement is magnified. It also shorterns the vertical range of the bow sight.*

Figure 22. String reference point.

String alignment.

Proper string alignment is necessary for consistent shooting. Both string and bow reference points are valuable aids for the archer in establishing proper string alignment. The string reference point can be located in the following manner. (1) Have the archer draw to his anchor point several times and after you are sure he is drawing consistently to the same anchor, make a mark (with a felt pen) at eye level on the string. (2) Let down the bow and tie a small string (dark in

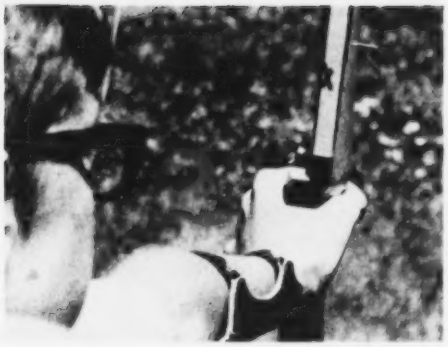


Figure 23. Bow reference point.

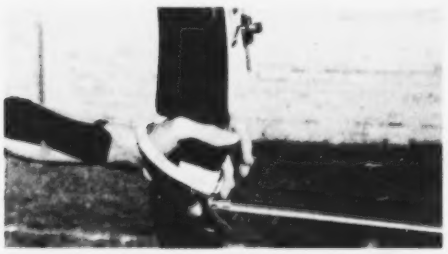


Figure 24. Wrist sling.

color) at this point to insure drawing to the same spot. (3) Again have the archer draw to anchor and place a mark on the bow at eye level to further aid head placement. (4) Use a small piece of masking tape on the face of the bow and place a dot, "x", or "+" on the masking tape for alignment. The head will be positioned so that the archer looks to the outside (arrow side) of the string.

A peep sight can also be used. It is made by splitting the string and inserting a peep sight between the strands of the string. Caution should be observed with the use of peep sights and eye level marks as they are not allowed in the FITA[1] round if they exceed one centimeter. This is a round that is shot in the national championships, the round to be shot in the Olympics, and the only round that is shot in the World Championships.

String alignment is extremely important for consistent shooting—in fact, more important than positioning the sight pin on the target. The margin of error in string alignment is more critical than error in placement of the sight pin on the target.

Bow sling.

There are two types of slings: a wrist sling and a finger sling. They are both designed to help the archer have a relaxed hold on the bow while maintaining a sense of security.

The important consideration is to maintain a consistent pressure. The sling should be snug enough to prevent the bow from jumping over 1 inch in the archer's hand. A common error is to use a bow sling that is so snug that the archer utilizes it as a brace. In some cases, a sling will stretch during use and change an archer's pattern of hits.

Arrows

Arrows are a critical—*possibly the most critical*—part of an archer's equipment. Once an archer decides to pursue archery beyond the basic instructional stage, a quality, matched set of arrows should be purchased.

Arrows are matched to a bow by the spine of the arrow—the amount of flexibility in the shaft. The greater the draw weight of the bow, the stiffer the arrow shaft. Materials used in the making of arrows fall into three categories: wood (Port Orford cedar), fiberglass, and aluminum. Aluminum has proven to be the best material for precision matched arrows.

The spine of an arrow is related to the archer's paradox. It must be matched to the bow so that it bends the right amount and hits where it is aimed. Arrows that are too stiff will group to the left of the target; arrows that are too limber will group to the right of the target.

Most top tournament bows today have the following advantages: (1) the window is cut past center, thus the arrow lies directly in the center of the bow and (2) most have adjustable arrow rests and adjustable pressure plates. These improvements have greatly reduced the effect of the archer's paradox, thus allowing the archer to use arrows of two or three different spine weights with the same bow by tuning the bow to the arrow.

Arrow weight is very important and all arrows should be matched within 5 grains of weight. The weight distribution should be such that the point of balance of all arrows is the same within 1/32 inch.

[1]FITA (Fédération Internationale de Tir à l'Arc) is the international archery federation.

instruction

The competent archery instructor possesses a depth of understanding beyond beginning instruction. Effective instruction requires the knowledge and understanding of why certain techniques or methods are utilized.

THE TEN STEPS IN SHOOTING

In this section a detailed analysis of the 10 basic steps in the shooting process is discussed with an emphasis upon individual rather than on group instruction. As an archer progresses he will modify his form and technique to fit his individual shooting style.

Step 1 — Establish Stance

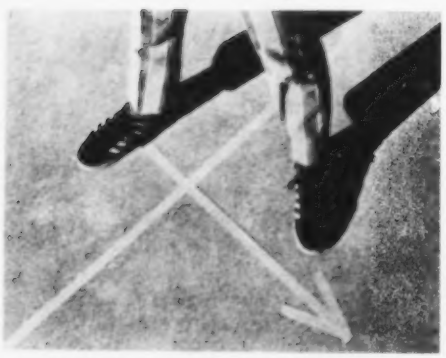


Figure 25. Oblique stance.

The oblique stance has been advocated for three basic reasons (p. 22). For the advanced shooter, a further reason for this stance is the position of the head during competition. It places the archer in a position facing the target and this eliminates from view the spectators behind the archer.

The stance is the foundation upon which the archer's form is built. The archer should spread his feet far enough apart to achieve a comfortable feeling. His feet should be firmly on the ground so that the entire foot—sole and heel—maintains contact. His weight should be evenly distributed between the two feet.

The body should be straight and perpendicular to the ground. The oblique stance places the body in approximately a 45 degree angle in relation to the target. This stance minimizes body sway. The knees should be locked to maintain body balance.

The stance should be accompanied with a confident attitude. An archer should learn to relax between each shot. Resting and relaxing allows the heart beat to return to normal. During rest periods the archer should review the previous shot and go through the 10 steps for his forthcoming shot.

Step 2 — Nock Arrow

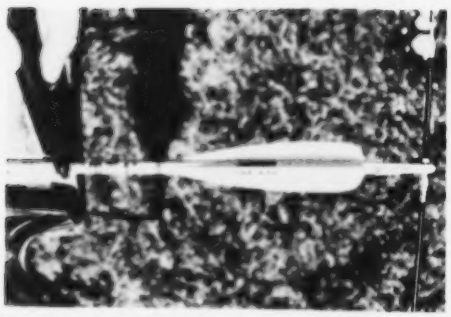


Figure 26. String height check.

The important point in nocking the arrow is to make it simple. There is no one correct way to do it, but it should be done the same way each time. A pattern will evolve as the archer shoots over a period of time. Establishing a pattern permits the archer to eliminate thinking about nocking the arrow and thus allows him to prepare himself for the shot.

When the string height is established, the archer should nock each arrow and make a small mark on the shaft where it meets the bow face. This affords a quick check for the archer to see if the string height is correct each time he shoots.

The serving diameter should be enlarged so that the nock of the arrow fits snugly on the string. The archer should check to make sure there is no gap between the string and the throat of the nock. If there is a gap, the arrow will fly differently on each shot.

To build up the nocking point the archer can use dental floss wrapped on the serving. After several wrappings, the floss should be heated with a match or lighter held under the spot. This will melt the wax in the floss, making a smooth nocking point.

Step 3 — Set Hook

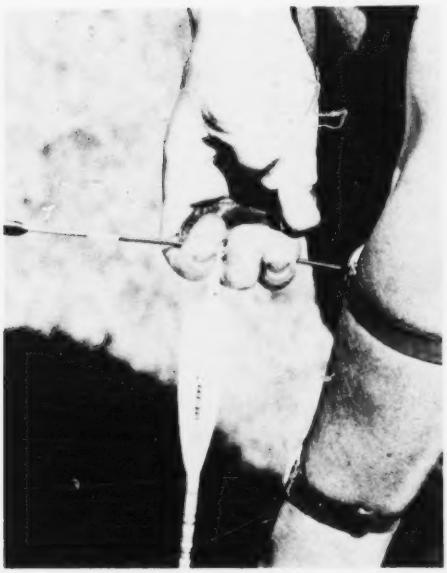


Figure 27. Setting a hook.

The fingers must be placed on the string the same exact way each time. It should be a very deliberate and thoughtful act. As the tab wears in, the archer will begin to feel the pressure of the string against his fingers. He should search for this pressure against his fingers on each arrow. The string pressure should be distributed on all three fingers, with slightly more on the middle finger. It is very important for the archer to give attention to this step each time he shoots. With the string lying in the first joints of the three fingers, the archer gains the feeling of strength, confidence, and control of the string. Many arrows have been shot involuntarily as a result of a flinch while holding on the target when the string is positioned on the pads of the fingers.

The fingers should be placed on the string with the index finger above the arrow and the other two below. This is called the *vent style*. Only slight contact with the arrow should be felt with the index and second fingers. If the archer places three fingers below the arrow, caution should be observed as this may throw the bow out of tiller.

Laminated bows, because of the material and construction, seldom have more than a ⅜-inch difference in length between the upper and lower limbs. If the archer draws back below the center of the string, the limbs will recover at an uneven rate upon release. Thus, "walking the string" with the drawing hand has such a terrific effect on bow limbs that some have broken under this procedure. Because of the slight difference in limb length (the lower limb is slightly shorter than the upper limb), the lower limb is actually stiffer and faster so that both limbs recover at the same time. This is called *tiller*.

Step 4 — Establish Bow Hold

Figure 28. Bow hold.

Figure 29. Raising the head.

In holding the bow, as in all other aspects of shooting, consistency is required. The archer's hand must be placed on the bow exactly the same way each time. This becomes critical especially after shooting continuously for an extended period of time. Fatigue may cause the hand to change its pressure point. A slight change in the pressure point of the bow hand will throw the arrow off slightly.

The tiller of the bow is affected by hand pressure. The hand position is below the center because the arrow is shot from the center of the bow. This hand position "dampens" the limb action of the lower limb, requiring the lower limb to be stiffer.

The deliberate placement of the hand on the bow is termed "working the hand into the bow handle." This occurs before the bow is raised. To avoid hitting anyone with the bow while on the shooting line, the archer should place the tip of the lower limb between his legs. The bow wrist should be relaxed, causing the wrist to break or cock when the string is drawn back. By basically assuming the position of a tired wrist, the pressure point on the bow will not deviate as the wrist becomes fatigued during extended shooting.

After the archer is sure that the hand and sling (if used) are exactly as he wants them to be, he should check the bow arm. The bow arm should be straightened and set before raising the unit to eliminate further thought about the arm.

Step 5 — Raise Head

Up to this point, concentration has been on the bow. Now the archer's focus is transferred to the target; it will take a transition or adjustment period to shift the concentration to the target. The archer's head should be in a natural position looking directly at the target, not canted (tilted) in any direction. This action sets the body and shoulders in a correct position.

Step 6 — Raise Unit

Figure 30. Raising the unit.

By this time, the archer has prepared himself mechanically for shooting by establishing his stance, setting his hook, positioning his bow hand and arm, and raising his head. While concentrating on the target center the archer should raise the bow in a deliberate manner and focus his eyes on the sight or on the target.

Although the sight can be used to orient the bow, the archer should concentrate on the draw and anchor without worrying about keeping the sight directly on the target center.

Step 7 — Draw — Anchor

Figure 31. Drawing to anchor.

The elbow of the drawing arm should be slightly elevated—not level. Two reasons dictate this position: (1) it gives the archer greater strength and back tension with the elbow up and pulling around in back rather than pulling straight back, and (2) the slight elevation affords a better hand position for the low anchor (the line of the jawbone rises as it goes back). The archer should get the feeling of strength, which is better accomplished with the elbow raised.

The drawing hand should be completely relaxed, with special attention given to relaxing the back of the hand and thumb. The draw should be felt in the shoulder and back muscles—not in the arms and hands.

The use of a pointer may help in pointing out where to relax. Telling the archer to relax may not produce the correct results. Use of a pointer, touching the shooter where he should relax, works like an electrical impulse to the muscle; it seems to work much better than touching him personally.

The low anchor should be established by the use of specific reference points. The string against the nose, lips, and chin are three reference points to check. The archer's hand position should also be checked. The chin should rest on the index finger with the thumb relaxed against the neck.

During the movement of drawing to anchor, the archer should take a deep breath, exhale about half of the air in his lungs, and hold his breath.

Step 8 — Aim — Hold

Perhaps the single most important part of aiming is concentration. The archer should hold his breath with enough air in his lungs to allow him to relax until the arrow is released. He must maintain pressure on the bow and bowstring with his back tension to insure a proper anchor point. After aligning the string, the archer should move the sight pin slowly onto the target center.

There are two places the archer may focus his eyes—on the target center or on the sight pin. Focusing upon one place causes a blurring of the other. If the eye(s) are focused upon the target, the same focus is retained as described in the beginning instruction. It is also consistent with the method employed in instinctive aiming. Some archers find it easier to focus on the sight, which may cause a problem called *eye drift*. Because of previously established eye focus on the target, the archer may switch the focus between the sight and the target while aiming and release the arrow somewhere between the two focal points.

It has been said that aiming is 90 percent psychological and 10 percent physical. The archer should accept as a phenomenon of aiming that no one can hold completely steady. Heart beat, nerves, and muscle tension all contribute to slight movement. The inability to cope with this movement may cause a psychological phenomenon called *target panic*. For the competitive archer, target panic must be

understood and dealt with. The oscillation or movement of the bow sight within the target center is acceptable.

The *hold* during the shooting of an arrow is the time it takes to move the sight onto the target center after all other previous steps in shooting have been completed and maintained. This normally takes from 5 to 10 seconds. At around 10 seconds and beyond, fatigue sets in and it is best not to shoot, but to let down and relax before starting the steps again.

Step 9 — Aim — Release

When the archer has the sight where he wants it (remember, it will oscillate—just be sure it is oscillating within the target center), he should concentrate on tightening his back to trigger the release. Relaxing the fingers of the drawing hand releases the string. It should be a totally unconscious effort, for when everything is right the fingers relax and the arrow flies forward as the string slips from the fingers.

If the archer must talk himself through the release he is in trouble—for instance, "I almost have the sight there; I am almost ready; there it is; let go." This type of release is known as a freezing condition. It is a deliberate release which has been triggered by the wrong approach.

During the release the archer must continue aiming. The unconscious act of a smooth release is more important to a good score than the actual aiming.

Just prior to the release of the arrow, many archers strive to hold the sight pin dead still instead of having it oscillate in the center. Fatigue sets in and results in a poor shot with the archer just thankful to release the arrow.

Step 10 — Aim — Follow Through

The follow-through is the act of maintaining the physical position and mental condition achieved at the time of arrow release until a specified time lapse after the release. The bow is pushed slightly to the left and down, and the drawing hand rubs the neck as it moves back and around the neck. The tension maintained in shoulder and back muscles by pushing on bow and pulling on string causes this reaction.

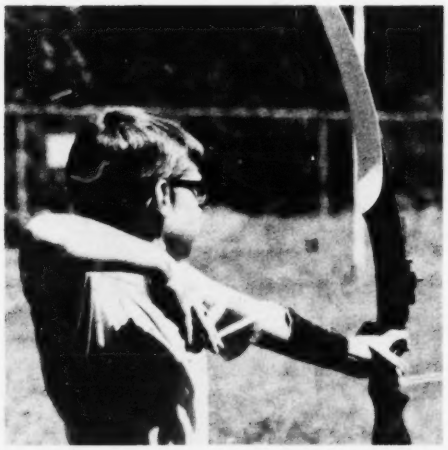


Figure 32. Follow-through.

It is important that the drawing arm and wrist and the bow wrist are relaxed. Tension must be felt only in the shoulders and back.

The purpose of the follow-through is to insure that the archer continues the act of aiming long enough to allow the arrow to clear the bow. If the archer fails to follow through until the arrow clears the bow, his movements may affect the arrow flight. A poor follow-through often results in a relaxing habit that causes the archer to lose his back and shoulder tension.

Eye control during the follow-through is an important factor. If the archer's focal point stays on the target center, regardless of where the arrow hits, complete eye control is maintained. If the eye tends to follow either the bow or the arrow, then eye control is lost.

The key to where the arrow goes is often directly related to where the eye is focused. The archer may think he is picking up the flight of the arrow in the air while he may, in fact, be focusing his eye at that point just prior to the moment of release.

If the archer focuses his eye on his sight instead of the target center, the problem is more difficult. At the moment of release the bow moves to the left and down, but if the archer has complete eye control everything in front of him will be blurred. His focal point should be in mid-air in front of him, and this blurred vision should remain for a second or two for perfect eye control. This is not difficult to master.

CAUSES OF FAULTY ARROW FLIGHT

High Arrows

Peeking – head goes up after the archer releases the arrow

Jerking – jerking the fingers off the string on release

Heeling the bow – putting pressure on the lower portion of the thumb which activates the lower limb

Leaning back – bending at the waist, pulling a shorter distance by leaning back

Freezing (Target panic) – physically unable to release the arrow when sight is on center of target; motivated by fear of missing the target center

Warped arrow

Overdraw – pulling arrows beyond normal anchor point

Miss-set sight

Bending an arrow – pressure applied to the arrow nock with the top finger of the drawing hand

Bad nock – nock not positioned properly on the arrow

Low Arrows

Collapse – losing back tension, allowing the drawing hand to move forward; arrow creeps forward before being released.

Overhold – maintaining the hold beyond the physical capabilities of the archer, resulting in loss of back tension and hunching of the forward shoulder

Soft release – loss of finger tension and forward motion of drawing hand, usually associated with the overhold

Head angle – lifting the head as the draw is under way

Bad string – as the string lets down (individual strands may be breaking), string height is lowered.

Bad nock

Miss-set sight

String hitting the arm guard – evidenced by wear on the arm guard; may be caused by hunching the shoulder resulting in improper alignment, or poor bow wrist alignment

Wind direction

Arrows to the Left

Bow cant – holding the bow with the window turned slightly to the ground

Tension in the string hand – cupping the drawing hand instead of having the back of the hand relaxed and straight

Body sway or tilt – tendency to lean back on heels; can be the result of improper alignment of the feet

Plucked string (different from jerking) – bringing the string away from the face and then releasing

Alignment – improper alignment of the bow, body, or string

Tab too thick – fingers unable to get around the string, causes plucking of the string

Miss-set sight

Wind direction

High Right Arrows

Jerking release

Change in finger pressure—normally caused by the index finger

Heeling the bow

Peeking

Bow torque—grabbing the bow forcefully on release, causes bow to twist in the hand

Poor alignment of string and body

Overdraw and head twist—head not directly at the target, but still drawing to the correct anchor point

Wind direction

Low Left Arrows

Collapse—soft release, plucking the string and body twist

Wrist break—affects the person who uses the extended wrist; as he releases, the wrist relaxes or breaks.

Bow torque or string alignment

Wind direction

ANALYSIS OF MUSCLES USED IN SHOOTING

From an advanced archery instructor, students will demand more detailed feedback as they attempt to refine their shooting technique. Their confidence in their coach will very much depend upon his ability to provide logical and understandable answers to their shooting difficulties. Failure to provide such answers can undermine the coach's status as an "expert" and severely limit his effectiveness.

The role that physical conditioning plays in enhancing the chances of success in competitive shooting is recognized by most archery teachers. An understanding of the muscles used in shooting can greatly increase a coach's ability to provide insights concerning proper shooting techniques and help him to formulate a beneficial exercise program. Using proper names for muscles and bones provides a common language to communicate effectively with students.

In this section an attempt will be made to show the relationship between the 10 basic shooting steps (the mechanics of shooting) and the musculature used in shooting. Insight into exercises that develop muscle strength and endurance will be provided.

Joint Movements

Establishing a nomenclature concerning the movements of joints is necessary so that body movements can be described with accuracy. Listed below is a brief description of the movements used in shooting.

Figure 33. Abduction of the humerus.

Abduction of the humerus.

The upper arm is raised away from the midline of the body.

Figure 34. Horizontal abduction of the humerus.

Horizontal abduction of the humerus.

The upper arm moves through a transverse plane away from the midline of the body at shoulder level.

Figure 35. Horizontal adduction of the humerus.

Horizontal adduction of the humerus.

The upper arm moves through a transverse plane toward the midline of the body at shoulder level.

Figure 36. Outward rotation of the humerus.

Outward rotation of the humerus.

The upper arm rotates along its longitudinal axis away from the midline of the body.

Figure 37. Inward rotation of the humerus.

Inward rotation of the humerus.

The upper arm rotates along its longitudinal axis toward the midline of the body.

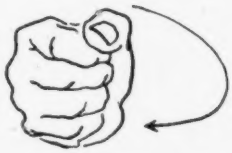


Figure 38. Pronation of the radius and ulnus.

Pronation of the radius and ulnus.

The forearm and hand rotate toward a palm-down position.

Figure 39. Supination of the radius and ulnus.

Supination of the radius and ulnus.

The forearm and hand rotate toward a palm-up position.

Figure 40. Extension of the radius and ulnus.

Extension of the radius and ulnus.

The forearm moves away from the upper arm.

Figure 41. Flexion of the radius and ulnus.

Flexion of the radius and ulnus.

The forearm moves toward the upper arm.

Figure 42. Abduction of the scapula.

Abduction of the scapula.

The shoulder blade moves away from the midline of the body.

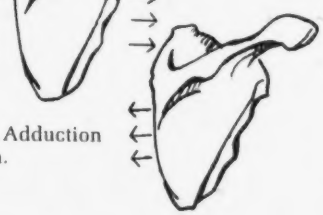


Figure 43. Adduction of the scapula.

Adduction of the scapula.

The shoulder blade moves toward the midline of the body.

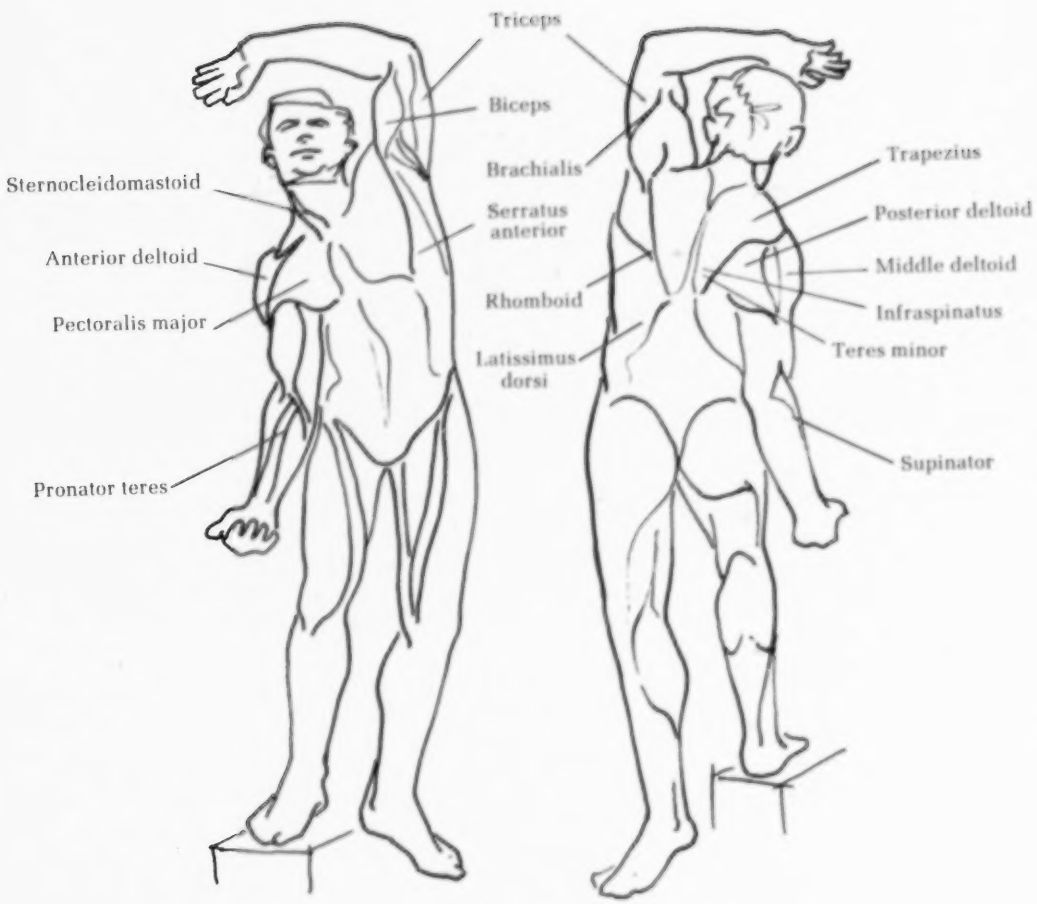


Figure 44. Muscles used in archery.

Although the terminology concerning the movements of bones and joints may be simplified in talking with students, it is necessary that the instructor understand the kinesiological terms used by professional physical educators and coaches. Rather than referring to the adduction of the scapula, he may say, "squeeze your shoulder blades together." The use of a few kinesiological terms enhances the students' confidence in the expertise of their archery teacher.

Significant muscle tension is not required in all phases of the shooting act. When considered in light of the 10 basic steps in shooting, muscle movement is extremely important only in Steps 6 through 8. The kinesthetics involved in each step of the basic 10 will be considered, with a detailed muscular analysis of Steps 6 through 8.

Step 1 — Establish Stance

The standing position is not a completely relaxed one. Gravity constantly attempts to collapse the body parts upon each other. Maintaining an erect position requires the active contraction of the body's extensor muscles. Standing is not a completely immobile position. The body sways in an anterior-posterior direction. The sway is caused by the antagonistic contractions of anterior and posterior muscles as we attempt to maintain balance. Fatigue tends to increase postural sway. The oblique stance is recommended because it minimizes the effect of postural sway upon shooting accuracy and increases the angle between the bow arm and the return path of the string.

Step 2 — Nock Arrow

Nocking the arrow on the bowstring requires some muscular coordination. However, because the muscle movements involved are unimportant, they will not be discussed here. For a discussion of the proper technique of nocking an arrow, see pp. 24 and 44.

Step 3 — Set Hook

The first three fingers of the drawing hand are placed on the string so that the nock of the arrow rests between the first and second fingers. The fingers are flexed in a hook position by the flexor digitorum muscles of the forearm. The string is placed in the groove formed by the first metacarpal joints of the three fingers (deep hook).

Step 4 — Establish Bow Hold

The extensor and flexor muscles of the wrist contract statically to stabilize the hand in an extended position. The muscles that are primarily responsible for stabilizing the wrist joint are the: flexor carpi radialis, flexor carpi ulnaris, extensor carpi radialis longus, extensor carpi radialis brevis, and extensor carpi ulnaris. These muscles are located in the forearm. The static contraction of the biceps, brachialis, and triceps stabilizes the elbow joint in an extended position. A slightly greater contraction of the biceps and brachialis prevents hyperextension.

Step 5 — Raise Head

Proper head position is maintained by contracting the trapezius and sternomastoid muscles. The trapezius muscle keeps the head in an erect position while the sternomastoid rotates the head toward the target. Proper head position ensures good alignment with the target.

Step 6 — Raise Unit

The bow is rasied and extended toward the target so that all the body parts are aligned with the intended flight of the arrow. Aligning the body parts prior to the draw increases the consistency of the drawing action. The entire upper body of the archer is involved in raising the

unit. The bow arm and hand raise the bow and extend it toward the target; the drawing hand and arm grasp the string and position it for the draw.

Raising the bow involves action of the bow hand, arm, and shoulder. The deltoid muscle abducts the humerus so that the upper arm is perpendicular to the midline of the body.

Raising the drawing hand and string involves action of the drawing hand, arm, and shoulder. The deltoid muscle abducts the humerus. At the same time, the pectoralis major and anterior deltoid muscles horizontally adduct the humerus. The resulting action raises the elbow so that it is perpendicular to the midline of the body and extends the upper arm forward toward the line of flight. The humerus is also inwardly rotated by the latissimus dorsi muscle. The triceps muscle extends the forearm and hand forward with the string as the pronator teres rotates the forearm inwardly and the string assumes its perpendicular position with the ground. The serratus anterior abducts the scapula to aid in extending the arm forward with the string.

Step 7 — Draw — Anchor

Drawing the bowstring requires the greatest *dynamic* muscular effort on the part of the archer. The fingers, arm, and shoulder of the drawing hand rotate with the string back to the anchor point. The greatest muscular tension should be supplied by the muscles in the shoulder and back. The rhomboid muscles, aided by the trapezius muscle, adducts the scapulae, sliding them toward the vertebral column. The humerus is horizontally abducted by the posterior portion of the deltoid muscle, pulling the elbow back in alignment with the intended flight of the arrow. The biceps and brachialis muscles flex the elbow. The muscular tension in the biceps and brachialis should be much less than that felt in the posterior deltoid, rhomboid, and trapezius muscles. The flexor digitorum muscles contract statically against the tension of the string in the deep hook. In the bow arm, the muscles of the forearm and shoulder contract isometrically and stabilize the humerus, radius, and ulna in an extended position.

Step 8 — Aim — Hold

The hold after the draw requires the greatest muscular effort on the part of the archer. The hold portion should be long enough to initiate a consistent releasing pattern without creating undue fatigue and tension on the drawing hand and arm.

Step 9 — Aim — Release

The release might be described as the sudden absence of muscular tension in the drawing hand and arm. The flexor digitorum muscles are relaxed and the string slides away from the fingers.

Step 10 — Aim — Follow Through

The follow-through is the controlled relaxation of muscular tensions in the upper body after the arrow is released. It is unnecessary for the archer to hold a rigid static position after releasing the arrow. Instead, he should relax muscle tension gradually with a feeling of complete control.

CONDITIONING EXERCISES

Archers should possess a sufficient level of physical strength and stamina to meet the demands of participation. It is obviously unnecessary for a recreational shooter to train as strenuously as a highly competitive one. Beginners should possess enough strength and endurance to enable them to participate in instruction with ease and success. The

bow must be drawn without undue strain a number of times during each instruction period. Struggling to complete the draw hardly lends itself to an efficient learning situation.

A physical conditioning program can benefit both the beginning and the expert shooter. The responsibility of an archery instructor is to design an exercise program that meets the needs of students. The goal is to improve their fitness level as efficiently as possible.

Below are a few specific strength development exercises that might be utilized as a portion of an overall conditioning program. These exercises are specifically designed to strengthen the muscles used in drawing a bow.

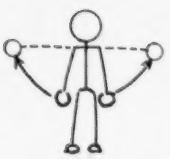


Figure 45. Exercise 1: Lateral raise—standing.

Lateral raise.
(Standing)

With a dumbbell or other weight in each hand, the arms are abducted to shoulder level. This is primarily a deltoid exercise.

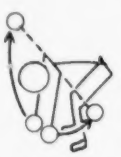


Figure 46. Exercise 2: Lateral raise—leaning.

Lateral raise.
(Leaning)

The upper body is leaning over so that it is parallel to the ground. With a dumbbell or other weight in each hand, the arms are abducted horizontally to shoulder level. This is an exercise for the trapezius, rhomboids, and posterior deltoids.

Figure 47. Exercise 3: Two arm curl.

Two arm curl.

With a dumbbell in each hand, the arms are stabilized against the sides of the trunk and then the forearms are flexed. This exercise strengthens the biceps and brachialis muscles.

Figure 48. Exercise 4: Shoulder shrug.

Shoulder shrug.

While holding a dumbbell in each hand the shoulder blades are elevated and adducted. This exercise strengthens the trapezius and rhomboid muscles.

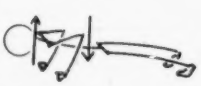


Figure 49. Exercise 5: Pushups.

Pushups.

From a front leaning position, the arms are alternately extended and flexed. This is primarily an exercise of the triceps and pectoralis major muscles.

Figure 50. Exercise 6: Finger flexor.

Finger flexor.
(Ball Squeeze)

A tennis ball or modeling clay is squeezed. This exercise strengthens the flexor muscles of the fingers.

A supplemental jogging program to improve the cardiovascular condition of archers is highly recommended. The Air Force Twelve-Minute Aerobics Program might be considered.[2]

PRACTICE

The purpose of practicing a skill is to develop certain behavior patterns. To be a highly successful archer requires consistency in some very complex and sophisticated muscular movements. These movements are developed to the point where the learner does everything the correct way each time he shoots.

It is beneficial for an archer to experience a degree of success throughout his practice sessions. Successful performance is a strong motivational factor that stimulates him to continue participation. This is as true for the beginner as for the advanced archer.

The capacities of the learner are important considerations when teaching advanced students. Their attention span, strength, age, and climate for learning (including home environment and desires) are some of the factors that influence practice.

During practice sessions, emphasis should be continually placed on following the 10 basic steps (p. 21). "Grooving" in archery is very important as it establishes a pattern or procedure for the archer to follow. In turn, the archer gains greater control over himself and his shooting accuracy.

General Learning Principles

1. The motivated learner learns more rapidly. The motivation should be relevant and appropriate in degree.
2. The learner is likely to learn much more from practice than intended—especially attitude. The instructor should be sure to display correct attitudes and values as a model.
3. Generally, the learning curve tends to be higher with increased skill; the increments of increased performance are smaller because there is less room for improvement.
4. Learning takes place best when the learner is not completely satisfied with his performance.
5. Failure is a great psychological pain and it is important for the archer to recognize both his progress and his problems. He feeds on the success of his progress in order to overcome his problems.

Practice Tips

1. Practice in an atmosphere that promotes concentration. Do not allow the range to become a coffee clatch; it should be quiet so that the archer's concentration is on shooting.
2. Allow the archer time to adjust psychologically to being closely watched by you. It may take several arrows or sessions, but the archer will eventually feel at ease as his shooting is observed and analyzed.
3. Space practice appropriately; it is preferable to mass practice.
4. Practice only when the archer can take his time on each arrow. A dozen arrows in five minutes does not promote good shooting. It would be better to skip a practice if it must be hurried.
5. If the archer must force himself to practice, don't insist that he continue. It would be better to skip one or several sessions until he wants to improve his skill. If the archer hits a slump in his shooting and everything seems to be going wrong, stop and help

[2]Kenneth H. Cooper, *Aerobics* (New York: Bantam Books, 1968).

him analyze what is happening. (He may acquire an exceptionally bad habit along with great frustration.) Then at the next practice session, try to resolve the difficulty.

6. In a diary or log, list problems encountered during practice sessions and when they were overcome. This makes the archer conscious of his improvement and helps him analyze his shooting.
7. Practice must have specific, obtainable objectives to be accomplished each session. Emphasis should be on shooting individual arrows, not tournaments.
8. Provide the archer with appropriate feedback, such as videotape, cameras, and mirrors.
9. When scoring in practice, always take the lower score on questionable arrows to eliminate any inflated average. If the archer knows that his improvements are genuine, his confidence in his shooting ability is enhanced.
10. Caution the archer not to expect higher scores when shooting in a tournament than his average in practice. Keep a daily average *by the end* (not by the game) and a running average by the end.
11. Practice should uncover the number of arrows needed for the archer to warm up. Knowing how long to warm up (practice) before shooting for score is essential for the competitor.
12. To take the boredom out of practice, use one session weekly to experiment. For example, ignore scores, shoot for patterns, change head angle, shoot facing the sun, or change the lighting.
13. When the archer reaches a plateau and possibly regresses, he very often will think that his equipment is holding him back. When such a peak is reached it may help to have another archer shoot with his equipment to help convince him that it is he and not the equipment.
14. The use of extremes may be necessary to correct faulty shooting form. Remember, deficiency in basic form causes most problems.

Points to Concentrate on During Practice Sessions

1. Analyze with the archer what he needs to work on and spend one or several periods in establishing the correct technique. It is better to stress the positive or correct technique than to emphasize the archer's error(s).
2. Help the archer develop concentration—a state of withdrawal from all external noise and distractions. Continually work on the archer to think through each arrow. As he improves on his thinking about each arrow, he will improve his concentration.
3. When shooting a field course, pick a particular distance at which the archer needs to improve. Have the archer try to increase his score at this distance by one point. After he has improved his skill at that distance, have him work on others until he recognizes that improvement of score depends on each individual target. As each distance is improved upon, each arrow becomes critical. Such practice develops an excellent competitive attitude.
4. Establish the time at which the archer wants to be shooting his best. Form, grooving, physical conditioning, and psychological motivation should all build momentum as the major goal approaches. As the tournament approaches, practice sessions should increase in number and duration, and the archer should shoot more often at the tournament distances.

intramural program

As the archer progresses from the beginning stages to a more advanced stage, his interest can be enhanced through participation in competitive activities such as intramural and Junior Olympic programs. An intramural program is an important step in providing inexpensive, convenient, and continued opportunities for students who want to pursue further activity in archery. The inclusion of archery in the intramural program also allows exposure to archery by students who are not enrolled in the skill courses.

Archery can be a year-round activity and need not be relegated to a seasonal program. League shooting can be established as well as periodic all-school tournaments. Indoor and outdoor tournaments and rounds can be conducted, including archery golf, clout shoots, field rounds.

For some of the tournaments it may be necessary and desirable to cooperate with local clubs and archery lanes. Archery golf can be shot on a local golf course during the off-season. The tournaments might be expanded to include local archers and/or other schools. Usually, local archery organizations will reduce fees to accommodate such events because they, too, are interested in promoting the sport. Remember to include novelty shoots and a variety of rounds to help keep the archers interested.

At the elementary school level, programs might be conducted during recess periods, noon hours, and in after-school programs. Junior and senior high schools can hold sessions before school in the morning, during the noon hour, or immediately after classes are dismissed in the afternoon. College programs can be conducted during supervised periods during the day, late afternoon, or evening. Saturday programs could be included at all levels. Extramural programs can also be established with other schools on a play day basis or by calling in scores to a central office while the tournament is shot at each local school site.

Participation in archery can be enhanced through the establishment of a club. If a group increases in participation, by all means establish such an organization. If, however, it impedes the goals of the archers, it would obviously not be worthwhile. The club could establish leagues, sponsor tournaments, and develop needed facilities and equipment in a long-range program.

Many intramural directors are inexperienced in archery and may need assistance from the archery instructor and the archers themselves. Volunteering services in the first year may determine the program's success and, in fact, whether or not archery will continue in intramurals.

Publicity is one of the most essential aspects of a successful program. Determine in advance what must be accomplished. Contact teachers and students through school newspapers, posters, word of mouth, duplicated handouts, and pictures. Provide information on the kind of tournament, awards, and equipment needed. Explain when and how to sign up and where the tournament is to be held. Increase the amount of publicity as the tournament time approaches. Advance sign-up boards give a good indication of how many participants can be expected. Provisions should be made for people to sign

up on the day of the tournament so that entries are not closed prior to the event. Post previous records and encourage beginners to enter by having divisions for various skill levels.

Practice sessions should be provided for students, with proper supervision and equipment available from the physical education or intramural department. A check-out system should be arranged so that whatever equipment is furnished for classes is also available for practice sessions.

Following a tournament or a weekly league shoot, post the scores. Everyone is interested in the results and participants want to know team and individual standings.

Some schools include tournaments in physical education classes, giving many students who might not otherwise participate an opportunity to shoot. Such an activity could be used as a qualifying round, in which a team or a certain number of the archers could be selected for an additional tournament.

Bump boards or ladder tournaments also create interest. Position on the ladder tournament is established by an initial shoot. Positions are then determined by the weekly shoots. Match shooting can be established by selecting shooters from different classes or leagues to compete in what could be called an all-star tournament.

Five ingredients important for a successful tournament are:

1. Purpose of the tournament
2. Advance planning
3. Development and adherence to tournament rules, time schedule, etc.
4. Effective publicity and communications
5. Evaluation of the tournament (what are the problems that weren't foreseen; how can it be conducted more successfully next time?).

Specific information on tournament rounds can be obtained by writing to the American Archery Council (AAC) or its member organizations: the American Indoor Archery Association (AIAA), Archery Lane Operators Association (ALOA), National Archery Association (NAA), National Field Archery Association (NFAA), and the Professional Archers Association (PAA). (For addresses, see Bibliography, p. 64).

The NAA has developed a Junior Olympic Archery Development Program for those under 18 years of age. It also conducts a high school mail match in the spring of each year for teams and individuals.

There are several rounds that are easily adapted to school facilities, including the PAA indoor round and the instructional rounds used by the AAHPER Outdoor Education Project in workshops and clinics (see p. 29). The Outdoor Education Project has also conducted postal archery tournaments for four-member male, female, or coed team entries, with four categories by grade level. The two postal rounds used are outlined below.

AAHPER Outdoor Education Project Amateur Postal Archery Round
(designed to be shot indoors)

Distance: 20 yards

Target: 20-inch, blue AIAA face

Total arrows: 60 (5 arrows per end; 4 ends per game; 3 games per round)

Score: 5-4-3-2-1

Total points: 300 per team member; 1,200 per team.

AAHPER Outdoor Education Project Amateur Outdoor Postal Archery Round

Target: 36-inch NAA face

Score: 9-7-5-3-1

Teams in the "Beyond High School" category

30 arrows from 40 yards, 30 yards, and 20 yards respectively (6 arrows per end; 5 ends from each distance.) Total points: 810 per team member; 3,240 per team

Teams in categories through Grade 12

24 arrows from 30 yards, 25 yards, and 20 yards respectively (6 arrows per end; 4 ends from each distance). Total points: 648 per team member; 2,592 per team.

glossary

Anchor point: The particular spot on the archer's face to which the index finger comes on the draw to give consistency to shooting.

Arm guard: A piece of leather or plastic that is worn on the inside of the forearm to protect the arm from the bowstring.

Arrow plate: A substance on the side of the bow to give point contact with the arrow.

Arrow rest: An extraneous device on the bow to provide point contact; also a resting point.

Back: The side of the bow that is away from the shooter.

Blunt: A blunt-tipped arrow, often used for small game.

Bow arm: The arm that holds the bow (not the string).

Bow sight: A device attached to the bow that allows the shooter to sight directly on the target (which cannot be done with the arrow tip except at point-blank range).

Bowstring: The string of a bow, usually made of dacron.

Broadhead: An arrow with a sharpened metal tip for hunting live game.

Butt: A backstop for holding arrows shot at a target.

Cant: The act of holding the bow tilted or slightly turned while shooting.

Cast: The distance a bow can shoot an arrow.

Cock feather: The arrow feather at right angles to the nock; often of a different color than the other feathers.

Creeping: Letting the string hand edge forward before release.

Crest: Paint or decoration on the arrow shaft near the feathers.

Draw: The acting of pulling the bowstring back into the anchor position.

Drawing arm: The arm that draws back the bowstring.

Drift: Natural deflection of an arrow from its normal path due to outside factors, such as wind.

End: A specified number of arrows shot at one time (or from one position) before retrieving.

End loop: The part of the string that fits over the bow nock.

Face: The part of the bow facing the shooter; also, a target face.

Fast: An expression used to warn people of arrows being shot.

Field archery: A competitive round shot at various distances and laid out like a golf course.

Field arrow: An arrow with a field point, used outdoors for field archery, stump shooting, roving, and small game.

Finger tab: A tab worn on the drawing hand to protect the fingers and give a smooth release of the bowstring.

Fletching: The feathers of the arrow which give guidance to the arrow's flight.

Flight: A competitive round of shooting for distance; also, the path of an arrow.

Free style: Shooting with the aid of a bow sight.

Glove: A covering worn to protect the fingers from the string.

Grip: The handle of the bow, held by the archer when shooting.

Handle riser: The center part of the bow.

Head: The tip or point of the arrow.

Hen feathers: The two feathers not at right angles to the nock; usually the same color (but different from the cock feather).

Hold: The act of gripping the bow; hesitating at full draw.

Index: The raised piece of plastic on the nock of an arrow that is in line with the cock feather.

Instinctive shooting: Aiming and shooting arrows instinctively rather than using the pre-gap or point-of-aim methods or a bow sight.

Jerking: Letting the drawing hand jerk too far back as the arrow is released.

Kick: The recoil of the bowstring and bow after the arrow is released.

Laminate: A composite bow, usually of wood and fiberglass.

Limbs: The two ends of a bow, from the handle riser out.

Longbow: A bow with no recurve.

Nock: The groove in the end of the arrow in which the bowstring fits; also, the groove at each end of the bow which holds the bowstring in place.

Nock locator: The material on the bowstring used to indicate the exact nocking point for the arrow.

Nocking point: The marked place on the bowstring where the arrow nock is placed before drawing and releasing.

Overbowed: Using a bow that is too heavy for the individual.

Overdraw: Drawing the arrow back too far so that the tip passes the face of the bow; dangerous practice.

Point: The tip on the end of the arrow.

Point blank range: The only distance from the target at which the point-of-aim is right on the target center.

Point-of-aim: A method of aiming using a point, usually in front of the target, with which the point of the arrow is aligned; allows for trajectory of the arrow.

Pre-gap (Pre-draw gap): A method of aiming.

Quiver: A container to hold arrows; can be ground, back, side, or pocket type.

Recurve: A bow that is curved on the ends.

Reflexed bow: A bow with limb ends curving toward the back rather than toward the face of the bow.

Release: The act of letting the bowstring slip off the fingertips.

Roving: A game played by two or more in the out-of-doors in which natural targets (stumps, trees, bushes) are selected for accuracy competition.

Self arrow: An arrow made entirely of one piece of wood.

Self bow: A bow made entirely of one piece of wood as opposed to bows such as laminates.

Serving: The thread wrapped about the bowstring to prevent fraying of the string.

Shaft: The middle of an arrow; an unfletched arrow.

Shelf: The place on the bow where the arrow rests.

Sinking: The gradual loss of a bow's power.

Solid bow: A common reference to a bow that is made entirely of fiberglass or plastics.

Stance: A standing position assumed in shooting an arrow.

String: Preparing a bow for shooting; also, the bowstring.

String fingers: The three fingers used to draw back the bowstring.

String height: The distance between the bow and the bowstring at the handle. (Formerly, "fistmele"—a clenched fist with the thumb raised—was the approximate unit of measure for the correct distance.)

Strung bow: A bow that is ready to shoot.

Target archery: A competitive round shot at fixed distances in an open area.

Target arrow: A lightweight arrow with a target point.

Throwing: Moving the bow hand to the left upon release.

Understrung: A bow with a bowstring that is too long.

Vane: A plastic fletching on an arrow.

Weight: The amount of effort (in pounds) required to draw the bow a given length (normally measured at 28 inches).

Weight in hand: The actual weight of the bow.

Windage: The amount of drift in the flight of an arrow caused by wind.

Wobble: The erratic motion of a flying arrow.

bibliography

Books

American Association for Health, Physical Education, and Recreation. *Physical Education for High School Students*. 2d ed. Washington, D.C.: AAHPER, 1970.

Athletic Institute. *Archery*. Sports Techniques Series. Chicago: the Institute, 1971.

Burke, Edmund. *The History of Archery*. New York: William Morrow & Co., 1957.

Division for Girls and Women's Sports. *Archery-Riding Guide*. Washington, D.C.: AAHPER. Published biennially.

Haugen, Arnold O. and Metcalf, Harlan G. *Field Archery and Bowhunting*. New York: Ronald Press, 1963.

Keaggy, David J., Sr. *Power Archery*. 2d ed. Paradise Valley, Ariz.: Power Archery Products, 1968.

Klann, Margaret. *Target Archery*. Reading, Mass.: Addison-Wesley Publishing Co., 1970.

National Archery Association. *The Archer's Handbook*. Ronks, Pa.; Clayton Shenk, 2833 Lincoln Highway East, 1968.

Niemeyer, Roy K. *Beginning Archery*. Rev. ed. Belmont, Calif.: Wadsworth Publishing Co., 1967.

Pszczola, Lorraine. *Archery*. Philadelphia: W. B. Saunders Co., 1971.

Periodicals

Archery Magazine. P.O. Box H, Palm Springs, Calif. 92262. Monthly. Official publication of the National Field Archery Association.

Archery World. 534 N. Broadway, Milwaukee, Wis. 53202. Monthly. Official publication of the National Archery Association.

Bow and Arrow. Gallant Publishing Co., 116 E. Badillo, Covina, Calif. 91722. Bimonthly.

Films

Archery. Set of 4 color Super-8 cartridge film-loops. Ealing Films, 2225 Massachusetts Ave., Cambridge, Mass. 02140. The sets cover the Basic skills; Nock, anchor, and release; Aiming (pre-gap method); and Aiming (sight method).

Archery Today. 16 mm., sound, color, 22 min. Rental from Grayling Film Service, Route One, Grayling, Mich. 49738 ($10). The film deals with hunting safety.

Men's Archery and *Women's Archery*. Set of 3 Super-8 loop films. The Athletic Institute, 705 Merchandise Mart, Chicago, Ill. 60654. Each set includes Stance—nocking the arrow; Draw, aim, and hold; and Release and follow through.

Outdoor Education. 16 mm., sound, color, 28½ min. Purchase or rental from NEA Sound Studios, 1201 16th St., N.W., Washington, D.C. 20036. A portion of the film is devoted to archery as part of an outdoor education program.

Archery Organizations

The American Archery Council (618 Chalmers, Flint, Mich. 48503) is a coordinating council with representation from the national archery organizations, including:

American Indoor Archery Association (AIAA)
P. O. Box 174
Grayling, Michigan 49738

Archery Lane Operators Association (ALOA)
729 Frederick Road
Baltimore, Maryland 21228

Archery Manufacturers Organization (AMO)
618 Chalmers
Flint, Michigan 48503

National Archery Association of the U.S.A. (NAA)
Box 48
Ronks, Pennsylvania 17572

National Field Archery Association of the U.S.A. (NFAA)
Route 2, Box 514
Redlands, California 92373

Professional Archers Association (PAA)
1500 N. Chatsworth Street
St. Paul, Minnesota 55117

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also available from AAHPER:

Archery Skills Test Manual for Boys and Girls

One of a series of seven manuals designed to improve teaching and evaluation of sports skills. Contains a series of skills tests with national norms for boys and girls, ages 10-18. Complete instructions for administering the tests and suggestions for their use as instructional aids are given. Also available: class composite records, personal data and profile forms, and squad score sheets.

DGWS Archery-Golf Guide

A guide containing official rules for the sports and for officiating, as well as articles of interest to players and teachers.

DGWS Archery Technique Charts

Bulletin board posters illustrating basic techniques. Includes 12 charts, title strip, and references.

available from:

AAHPER Promotion Unit
1201 16th St., N.W.
Washington, D.C. 20036

DGWS Selected Archery Articles

A collection of the most popular and useful articles from *DGWS Guides* during the period 1948-1970, and the *Journal of Health, Physical Education, Recreation*. First edition, 1971.